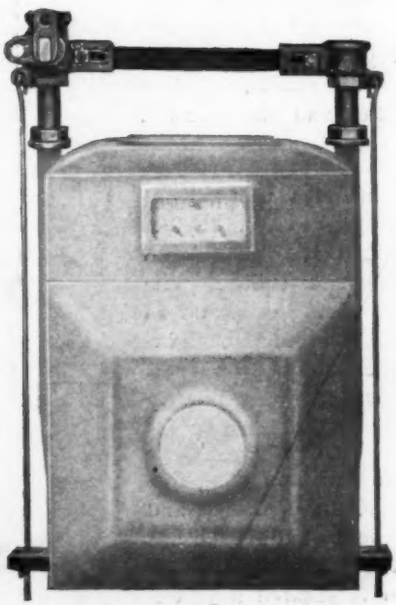
American
GAS JOURNAL
Formerly American Gas Light Journal
EST. 1859

VOL. 117, NO. 7
WHOLE NO. 3362

NEW YORK, SATURDAY, AUGUST 12, 1922

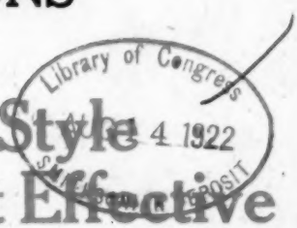
Subscription $3 per year
$4 Canada $5 Foreign

LATTIMER-STEVENS
METER CONNECTIONS



No. 45 Connection with Shelf
(Red brass lock wing cock built into inlet end)

No. 40 Connection Apart



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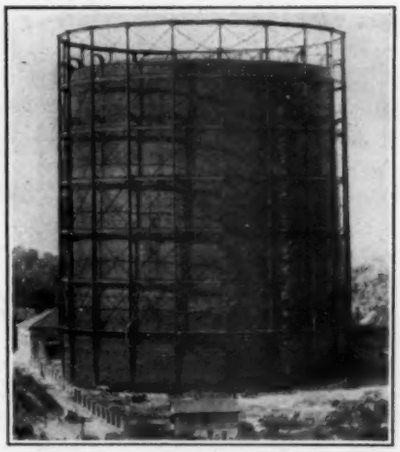

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American Gas Journal

SIXTY-THIRD YEAR

Published Weekly by American Gas Light Journal, Inc., 53 Park Place, New York, N. Y.

ELBERT P. CALLENDER, Pres. S. G. KRAKE, Vice-Pres.-Treas. A. M. GLEASON, Sec'y

WALTER A. FAIRSERVIS, Editor

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Subscription $3.00 per year, including postage, in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines; in Canada, $4.00; foreign, $5.00—Single Copies, 10 cents.

AMERICAN GAS JOURNAL. August 12, 1922. Vol. 117, No. 7. Published weekly by American Gas Light Journal, Inc., New York, N. Y. Entered as second-class matter Jan. 9, 1917, at the post-office at New York, N. Y., under the Act of March 3, 1879.

American Gas Journal
Formerly American Gas Light Journal

Vol. 117, No. 7 NEW YORK, AUGUST 12, 1922 Whole No. 3362

Notes on the Heating of Water and Other Liquids

What Has Been Learned in Industrial and Commercial Work

By THOMSON KING

There are six known ways of heating water and other liquids by gas. No one method is best; each has its own peculiar advantages and disadvantages; for each individual case there must be one best way. There still exists a wide diversity of opinion and practice within the gas industry as to the relative merits and values of the different methods. Where no such honest difference of opinion exists, a study of the advantages and disadvantages of the various methods should prove interesting.

1. The first of the six methods may be called the "primitive." It consists of the heating of some object, such as a stone or a piece of iron, in a fire and dropping it into a vessel containing the liquid to be heated. So primitive man heated his water in a gourd shell or a bucket made of hide. So the American Indian boiled water in a bucket made of birch bark. When we send steam directly into water in an open tank, we are using a modern variation of this most ancient of methods.

2. The next in point of time and simplicity is the method of putting a vessel over the fire or, what is the same thing, putting burners under the container. This method is in wide use to-day.

3. Then we have the "storage" type. This method is in most general use. In this, water is heated in a heater or boiler which is connected to a storage tank or other containing system; the heater may be contained in the tank or may be separate from it. To this type belong not only the true storage system with its heater and tank, but we may consider the hot-water house-heating system as a variety of this species.

4. The next type we call the "instantaneous" heater. In it the water is heated as it is drawn through the heater on its way to the point of use; there is no circulating system and no storage tank. The gas is usually turned on by the flow of water.

At this point it may be well to pause and point out that there is a great deal of confusion of terms in regard to automatic and instantaneous heaters. Even among gasmen, who should know better, the designations are often used synonymously. Yet it is perfectly clear that while all instantaneous heaters are automatics, all automatics are not instantaneous heaters. If the term "instantaneous" or "instantaneous automatic" was always used to designate the true instantaneous type, and the type "automatic" or "automatic storage" used for the non-instantaneous type, much misunderstanding and confusion would be avoided.

5. The fifth division contains all systems where steam generated in a steam boiler is made to heat water in a tank or other container either by placing a steam coil in the tank or by blowing steam directly into the water to be heated. We will call this the "indirect method."

6. The sixth and last method, which is also the newest in point of use and development, is the "immersion" type—where gas is burned inside of a pipe or other container which is immersed in the water or other liquid to be heated.

The First Two Methods

The primitive method may be dismissed without extended consideration, because its obvious disadvantages and limitations have caused it to be abandoned for more convenient methods.

The second method is the most widely used of any; all manner of pots, pans, cauldrons and tanks are placed over burners, or where they are so large as to require permanent positions burners are placed under them. The method is so simple it needs little comment except to point out that it should not be used where the nature of the liquid or the work being done in the vessel is such that its bottom becomes foul with sludge, scale or other deposit, as this leads to low efficiency and possible burning out of the bottom.

The efficiency of this method is usually low; heating in a small open vessel over an open burner, as on a range—20 to 38 per cent depending on the shape and size of container in relation to the burner, the rate of heating desired and other factors. For the tank or cauldron with burners beneath it and enclosed by brick setting or metal skirting and having a vent with damper to regulate draft, we should obtain efficiencies of 25 to 50 per cent.

Cast Iron vs. Copper

Such an animated controversy has raged with regard to the relative merits of the storage and instantaneous types that it will be well to consider them together and to endeavor to show the relative values of the two types for commercial work; but before taking this up it will be necessary to consider another much-discussed question which is of the greatest importance and on which opinions differ as widely. This oft-debated subject is the relative merits of cast-iron and copper tube as materials for water heaters.

Material when considered for the heat-absorbing surfaces of a water heater must be judged for two sets of qualities: first, its merits with regard to the efficient transfer of heat from gas to water; second, for its qualities from the point of view of construction, such as strength, workability, cost, ease of fabrication and assembly, freedom from corrosion, endurance, appearance, etc.

In the water heater we have our heat developed in our gas flame and desire to put as great a percentage of this heat as possible into our water. There are three stages to this process: the absorption of the heat from the flame and hot gases by the metal; the conduction of the heat from the outer to the inner surface of the metal, and the transfer of the heat from the metal to the water. Each of these stages represents a certain amount of resistance to the flow of the heat, and the total resistance is the sum of the three; but the amount of resistance in the three stages differs greatly. The resistance of the first stage is by far the greatest; those of the other two are almost negligible in comparison to it. It may safely be asserted that of the total resistance, over 90 per cent lies in the first stage. This is forcefully illustrated if we consider the conditions existing in a high-power coal-fired boiler. The temperatures of the gases surrounding a water tube or water surface may be 2,000 to 2,500 deg. Fahr; the temperature of the water on the other side of the metal is, say, 380 dg., and the temperature of the fire side of the metal is only a few degrees above the temperature of the water. The differences in temperatures fairly represent the magnitude of the resistance of the various stages to the flow of heat. They show conclusively that the resistance of the first stage—that is, the transfer of heat from flame and hot gases to the outer skin of the metal—is enormously greater than the sum of the resistances of the other two stages. The foregoing argument shows that a prime requisite of material for water heating and boiler work is that it be a good absorber of heat; its conductivity is a matter of much less importance, as this only affects the transfer of heat from the outer to the inner skin of the metal, and this represents a very small percentage (often less than 2 per cent) of the total resistance from flame to water.

The Ideal Absorber

Bright polished surfaces are poor absorbers of heat; dark rough surfaces are good absorbers. The ideal absorber is a black, rough surface; hence, cast iron is a better absorbing surface than bright, smooth copper, although the fact that copper in a water heater does not stay bright probably improves its absorbing qualities. The heat conductivity of copper is nine to ten times as great as cast iron; but, as we have seen, this can affect the total resistance to heat flow very little, as it influences such a very small part of the total resistance.

The efficiency of a water heater or boiler will depend upon the heat-absorbing qualities and not upon the heat conductivity of its material. The ability to absorb heat depends upon the amount of surface exposed to the flame and hot gases, the temperature differential between the gases and the absorbing surface, and upon the quality of the surface as an absorber of heat. The advocates of copper have advanced the argument that the roughness of the cast-iron surface tends to hold cold gases in the minute irregularities of the surfaces, but this theory has little evidence to support it and the results of the tests the writer has been able to observe do not support it; on the contrary, they rather support the conclusions that for the construction of water heaters and boilers higher efficiencies can be secured for an equal expenditure in material with iron than copper.

The conclusions springing from the considerations we have just cited are: That from the standpoint of efficiency, water heaters should have iron heat-absorbing surfaces, so disposed as to furnish maximum contact with the hot gases and to facilitate rapid circulation of water through all parts, and so arranged that there will be no dead pockets for either water or gases; they should, of course, also be provided with insulated casings to reduce radiation.

Important as are the efficiency considerations, the structural and wearing qualities must be given at least equal weight. The effect of the gases on the outside and of the water on the inside must be reckoned with. The nature of the two materials causes the cast-iron heater to be much heavier than copper tube; but cast iron costs much less per pound than copper, and it appears that the manufacturer can give the purchaser about the same amount of effective heat-absorbing surface for his dollar in cast iron or copper. With regard to strength, either is strong enough to meet all reasonable requirements.

With regard to life, the advantage must be conceded to cast iron, as few materials can equal it in this respect. The effect of the water on the inner surfaces or, what is the same thing, the effect of the inner surfaces on the water, the latter being the effect of the former cause, is a most important question. The advocates of copper accuse the cast-iron heater of producing rusty water, and point to numerous instances to support their case. On the other hand, water is universally heated in coal-fired cast-iron heaters and boilers without trouble from rusty water. It is held and conveyed in steel tanks and pipes, which are much more susceptible to rust than cast iron. We know that iron submerged in water containing no oxygen cannot rust, but almost all water contains more or less oxygen. Any iron surface under water will, therefore, rust to some extent, but our coal-fired heaters give no trouble from rusty water; why should the gas heater?

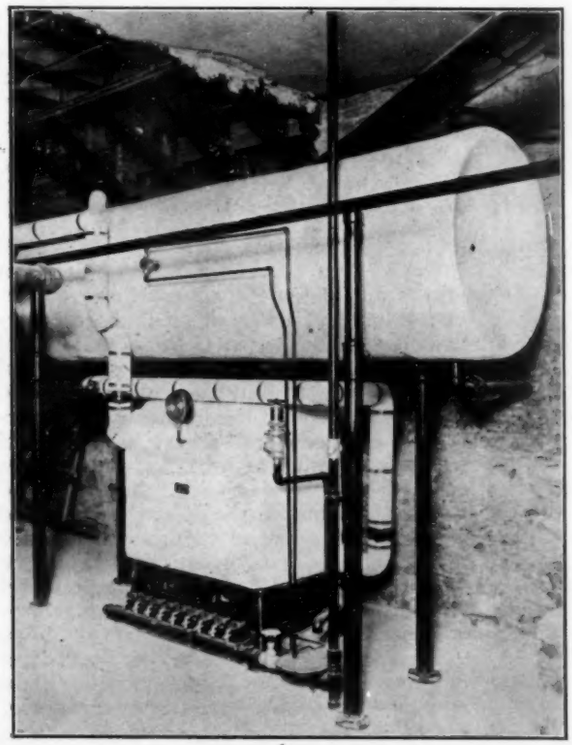
The writer is convinced by continued observation that the truth of the case is as follows: Cast iron rusts on the surface, but this forms a protective coating and, like cast-iron pipe in the ground, the rust will do no material harm. This rust also sticks fairly tight and under ordinary circumstances will give no trouble. When, however, the heater is run abnormally hot and steam begins to form, the agitation of the water may be so violent as to dislodge some of the rust and discolor the water; but this is distinctly an abnormal condition, and one that will not occur in a heater under automatic control.

When we are dealing with very bad water carrying a large amount of mineral salts, which tend to deposit in the form of scale in the passages of the heater, the copper tube, with its smooth, continuous inside surface, has an advantage over cast-iron sections put together with steel or wrought-iron nipples, as it is in these that trouble usually develops. But water must be very bad to prohibit the use of a cast-iron heater.

We may sum up the case of cast-iron sections vs. copper tube from the structural viewpoint, as follows: Each possesses ample mechanical strength. Cast iron will last longer, especially on heavy duty commercial work, than copper of the thickness in general use for

heater coils. This ruggedness, which insures longer life, carries with it lower maintenance cost and less chance of shutdown for repairs. The cost of the two materials for equal heating capacity is not very different, nor will there be much difference in the space occupied. The fear of rusty water from the iron heater is not supported by facts, being rather a popular superstition.

Where very bad water must be handled, the continuous smooth surfaces of the copper tube present some advantage. For general industrial and commercial work, however, especially for heavy duty work, cast iron is beyond doubt the superior material and should be selected.



Automatic Storage System—Nine-section cast-iron heater, rated at 430 gal. per hour at 60 deg. temperature rise, 300-gal. steel tank

The great popularity of the copper tube heater for domestic work, in which it has largely supplanted the cast-iron type, is due to the belief that copper heaters are much more efficient and that cast-iron heaters cause rusty water. Both of these ideas are based on popular misconceptions. A third cause of popular favor is the more attractive appearance of the copper coil heater when displayed to the prospective customer; this has played a great part in the domestic sales, but should carry much less weight when commercial applications are being considered.

Instantaneous vs. Storage Type

We now arrive at the second question, on which opinions differ widely, and in discussing it we will endeavor to be brief in order that the reader may not be wearied by the repetition of too familiar arguments.

First looking at the problem from the point of view of the gas company, there is no room for any argument whatever. It is very much easier and a great deal more profitable to supply the storage heater a small amount of gas for a long time than the instantaneous type a large amount for a very short time; the latter demands a larger service and meter from the company and a larger house pipe from the customer, and if these are not provided it becomes a prolific breeder of trouble calls and dissatisfaction. Large services and meters mean high fixed costs and low profits. From the point of view of the gas company, the instantaneous heater is very undesirable, to say the least.

From the point of view of the customer, which must include first cost, economy of operation, satisfaction of service and life and reliability, the case is not so easily decided and dismissed. Taking first cost, we will find that a first-class automatic storage system with well-insulated tank, installed and connected complete and ready to operate, will cost more than an instantaneous system of like rated capacity. How much more? In some cases 50 per cent; in others, not so much. First cost, however, is a deceitful criterion of merit. How do operating costs compare? On this point many figures have been used and much has been said; also there has been a great deal of jumping to conclusions.

The answers to the questions we have just proposed will, of course, vary with conditions of use; the more infrequent the use and the longer the periods between the drawings of water, the more favorable will the showing be for the instantaneous type. On this account the instantaneous type will make a better showing in domestic than commercial use. Some careful and accurate tests have been run, and it is to the results of these we must look for evidence to settle the controversy. The writer believes that the majority of these tests show that even for residence work, the operating costs per million B.t.u. delivered in the water at the point of use is slightly less for the storage than for the instantaneous heater.

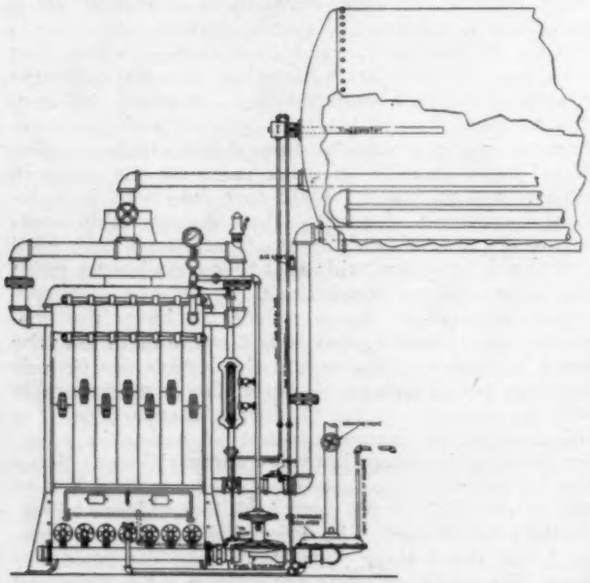
A careful test was conducted by L. B. Wilson in Baltimore. A storage and an instantaneous type heater were installed in a house and used by a family of medium size. The water was metered and the incoming water temperature was noted. The two heaters were operated one week at a time alternately until each heater had been operated a total of ten weeks. The results when compared showed an average of 19 cu. ft. of gas per cubic foot of water heated for the storage type and 19.7 for the instantaneous type. In this test the amounts of water used by the two heaters were almost exactly equal. It may therefore be assumed that the temperature of the water at the points of use was the same.

Mr. Schuetz, of Milwaukee, reports several tests which seem to have been carefully and accurately conducted. In these tests, when the storage tank was properly insulated the gas per million B.t.u. in the water at the point of delivery was less for the storage than the instantaneous type.

It is interesting to note that from the results of a number of tests it appears that for ordinary conditions we may conclude that 2.5 cu. ft. of 550 B.t.u. gas will be used per gallon of water heated.

When we consider satisfaction of service, practically everything is in favor of the storage type. The

first point to be noted is that the flow of water through the instantaneous-type heater is limited. A No. 8 heater is supposed to give 8 gal. of water per minute with a 60-deg. rise, but if hotter water is desired the flow must be throttled before the increased temperature can be obtained. This is not true of the storage type. This also means that the faucet nearest the heater usually passes a greater amount of hot water than the more remote faucets. Also, the instantaneous type of heater will not operate properly unless there is considerable water pressure, a trouble from which the storage type does not suffer. The water drawn from the instantaneous-type heater must necessarily vary in temperature with the rate at which the water is being drawn.



Indirect Automatic Storage System—Cast Iron, low pressure water tube boiler, tank with steam coil, fuel control governor, thermostat and connections shown in diagram

Passing to the question of life and reliability, it will be generally conceded that, except for very light work, the storage type with a cast-iron heater is much more free from maintenance troubles and has a very much longer life than the instantaneous heater. This has been proved again and again, especially where the duty the heater is called upon to perform is heavy and continuous, such as in hotels, restaurants and industrial plants.

One of the most prolific sources of complaint with instantaneous heaters is the wire gauze used in the burners. The use of a gauze in any burner is an admission of poor design or weakness, and an invitation to trouble. A well-designed burner needs no gauze.

What we have just said with regard to operating costs and service satisfaction may seem to be derived from domestic practice, but if these conclusions are true for residential conditions they must hold to an even greater degree for commercial and industrial installations. We may confidently assert that for such work the storage is the type to be selected. The following summary is meant to apply to commercial conditions:

1. The instantaneous heater is cheaper in first cost.
2. Operating costs of the two types are slightly in favor of the storage type.
3. The quality of service rendered is higher from the automatic storage type.
4. The maintenance cost is lower, the reliability greater and the life longer for the storage type, especially if equipped with a cast-iron heater.
5. From the point of view of the gas company with regard to service and meter supply, the storage type is very much the more desirable of the two.

Score: Four points for automatic storage, one for instantaneous.

For rugged, efficient and enduring commercial installations, use cast-iron heaters, liberal sized storage tanks, reliable thermostats and cover tanks, heaters and piping with good heat insulation.

The Indirect Method

This method finds some very useful applications in commercial work. It is especially well adapted for very large tanks and extensive applications. It has the great advantage that no fresh cold water enters the gas-fired boiler, which obviates the possibility of its tubes or passages becoming fouled by scale and of strains and cracks due to sudden chilling by cold water coming in contact with the heat-absorbing surfaces. Where it is necessary to heat a number of tanks, or where we desire to heat water from the same boiler that is supply steam for other uses, and especially where the water to be heated is bad and tends to deposit scale, it meets requirements better than any other system. It is also useful where the water pressure is too high for a cast-iron sectional boiler and where the liquid to be heated is an acid or other corrosive solution; in this case, steam is blown directly into the liquid, or a lead coil may be used in the tank. In all such cases, the gas-fired low-pressure steam boiler solves the problem. The advantages of this method are obvious in the applications we have just cited; its only disadvantages are slightly lower efficiency than the direct method and somewhat higher first cost. Good judgment will select those applications for which, all things considered, they will yield the best results.

In every case where this method is used, the proper covering of boiler, tank and all circulating pipes with good heat insulation is most essential to economy. This matter of insulation is so vitally important in all water-heater work that we cannot pass to our next subject without a few words to emphasize the need of always properly insulating our storage tanks and circulating pipes; the former are often covered, but the latter are usually neglected. Indeed, any hot-water pipe which is hot most of the time, especially if in a cold place, should always be well insulated. Money so spent earns a high rate of interest. Let us consider what this means in a typical case.

A tank 6 by 3 ft. is automatically maintained at 160 deg. The exposed area of the circulating pipe between tank and heater is 10 sq. ft., making the total radiating surface of tank and circulating pipe 80 sq. ft. Take the temperature of the room in which the

installation is located at 70 deg. We may safely assume the radiation from bare tank and pipe to be 120 B.t.u. per square foot per hour. This is a very conservative figure. The radiation loss in twenty-four hours will then be $80 \times 120 \times 24 = 230{,}400$ B.t.u. Assume the system to use 500 B.t.u. gas at 75 per cent efficiency. The gas necessary to supply the daily radiation cost will be $230{,}400 \div 500 \times 0.75 =$ 615 cu. ft. At $1 per thousand this will cost 61 cents per day, or, assuming a use of 300 days, we have a cost of $183 per year. This surprisingly large figure may be reduced to a small fraction by proper insulation.

The Immersion Heater

Of late years the immersion-type heater has been gaining in favor as a means of heating large tanks of water and solutions. It has many advantages for certain kinds of work, and it may be well to devote some attention to it here.

In this type, gas is caused to burn inside of a pipe or other container which is immersed in the liquid to be heated. The pipe must be provided with a vent and the gas burner must be provided with air blast or with gas at pressure high enough to entrain all air necessary for complete combustion.

The advantages of this method are: High efficiency, low first cost, saving of floor space. Its disadvantages are: It cannot be easily applied to small tanks; the heating element and vents take up room in the tank which cannot always be spared. It cannot be easily applied to tanks containing corrosive solutions. The burner is very likely to be noisy, and an atmospheric burner cannot be used.

The application of the immersion heater may be best illustrated by considering a practical application and comparing the advantages and economy of this method with others that might be used for doing the same work.

Suppose that it is necessary to heat 800 lb. of water in a wooden tank. Let the maximum duty be to heat the water from 50 to 190 deg. in one hour; the heater must also maintain the water at 190 deg. Assume 500 B.t.u. gas and a rate of 90 cents per thousand. Suppose the tank to be replenished with cold water at a rate which will fill it twice daily. The daily heat requirements are then to heat 1,600 lb. of water from 50 to 190 deg. and to maintain 800 lb. of water at 190 deg. eight hours per day. Also assume that 600 lb. of iron parts are washed in this water each day.

We will first figure our heat requirements.

To heat 800 lb. of water from 50 to 190 deg. will require $800 \times 140 = 112{,}000$ B.t.u.; 1,600 lb. will take 224,000 B.t.u.

Assuming that the iron parts that are to be washed have a specific heat of 0.118 and that they will be raised from 50 deg. to the temperature of the water, will require $600 \times 140 \times 0.118 = 9{,}912$ B.t.u.; say, 10,000 B.t.u.

The losses due to radiation and evaporation from the tank may be taken from experience at 20,000 B.t.u. per hour.

This water may be heated under the conditions we have proposed by the indirect, the direct or the immersion heater method. If we adopt the first we must

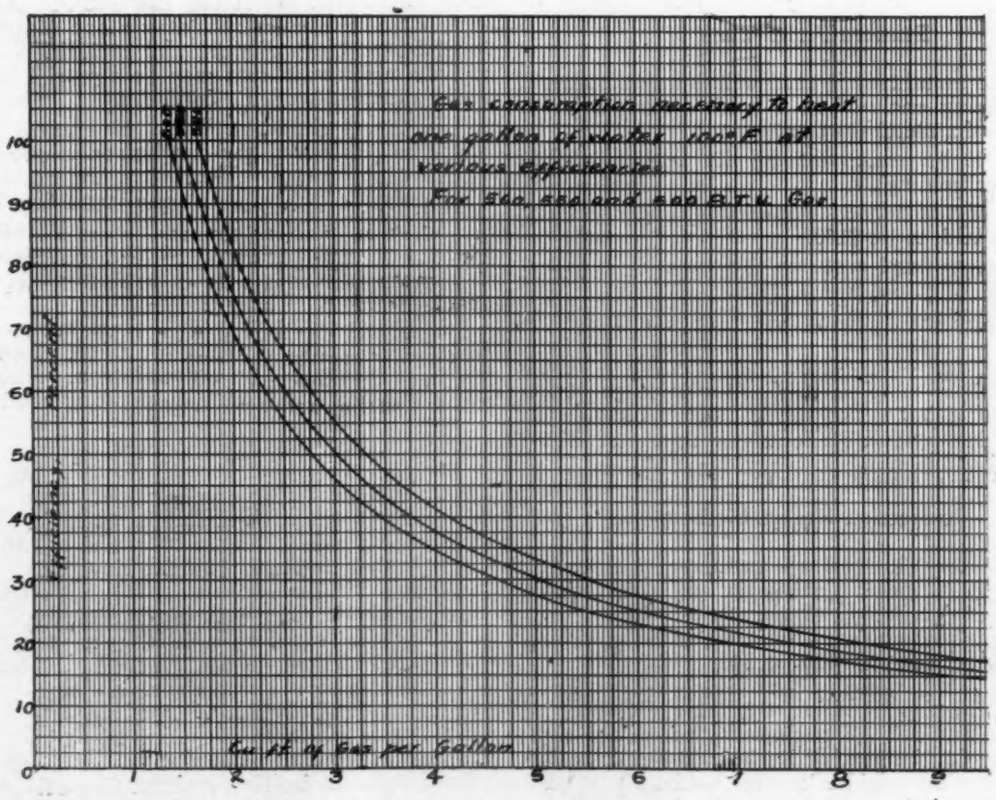


Figure 1—Efficiency and Gas Consumption

install a steam boiler and place a steam coil in our tank or blow steam directly into the water. The direct method will require the substitution of a metal tank in place of wood and the placing of burners under the tank, the whole being enclosed in a brick setting or metal skirting and vented. The last method involves cutting the tank and inserting the burner equipment and the use of a motor blower.

Gas-Fired Steam-Boiler Method

Calculation of Fixed Costs.—Allow 80 per cent efficiency for steam coil and connections between boiler and tank. Maximum heat requirements of tank are 112,000 B.t.u. per hour. Requirements from boiler are 112,000 ÷ 80 = 140,000 B.t.u. per hour; 140,000 ÷ 33,000 = 4.24. We must install a 5-h.p. boiler.

The cost of a good 5-h.p. low-pressure boiler, together with steam coil for tank and all other necessary accessories and piping, installed complete, ready to operate, is $600.

Allow annual fixed charges of 20 per cent to cover interest, depreciation, taxes, maintenance and repairs, or $120.

Fixed costs per working day are: $120 ÷ 300 = $0.40.

Running Costs.—Assume overall heating efficiency of 55 per cent and a holding efficiency of 40 per cent. Then gas used per day for heating is: 224,000 + 10,000 ÷ 0.55 × 500 = 850 cu. ft. Gas for holding: 20,000 × 8 ÷ 0.40 × 500 = 800 cu. ft. Total gas used per working day, 1 650 cu. ft. Running costs per day at 90 cents per thousand, $1.48. Total fixed and running costs per day, $1.88.

Burners Under Tank

Suppose a metal tank is used with burners under it, the tank being enclosed in a brick setting or with some kind of a metal skirting.

Assume 40 per cent efficiency for heating and 40 per cent for holding.

Assume cost of burners, connections and necessary changes in tank to be $150.

Then annual fixed costs on the same basis as before are $30, or 20 per cent of $150.

Fixed costs per working day are: $30 ÷ 300 = $0.10.

Running Costs.—Gas for heating: 224,000 + 10,000 ÷ 0.40 × 500 = 1,170 cu. ft. Gas for holding: 20,000 × 8 ÷ 0.40 × 500 = 800 cu. ft. Total, 1,970 cu. ft. Total running cost at 90 cents per thousand, $1.77. Total fixed and running costs per day, $1.87.

Immersion Heater Method

Fixed Costs.—The cost of an immersion heater, with burner, motor-driven blower and connections, installed complete, ready to operate, is $200.

Assuming fixed costs on the same basis as before, we have 20 per cent of $200, or $40.

Fixed costs per working day: $40 ÷ 300 = $0.13.

Running Costs.—Assuming a heating efficiency of 65 per cent and a holding efficiency of 70 per cent, gas used per day for heating is: 224,000 ÷ 0.65 × 500 = 720 cu. ft. Gas used per day for holding is: 20,000 × 8 ÷ 0.70 × 500 = 457 cu. ft. Total gas used per working day, 1,177 cu. ft. Total gas cost per working day at 90 cents per thousand, $1.05.

Assuming power consumption of motor-driven blower at 250 watts for ten hours' operation per working day and power at 8 cents per kilowatt-hour, the cost of power used is: 250 × 10 × 8 ÷ 1,000 = $0.20. Total running costs per working day, $1.25. Total fixed and running costs per working day, $1.38. Saving per year, immersion heater method over steam boiler method, $564 — $414 = $150. Saving per year of immersion heater over burners under tank method, $561 — $414 = $147.

Such savings over the costs of other methods are very attractive; particularly the low initial investment will recommend it to many prospects who would not consider the outlay necessary to install a gas-fired boiler of adequate size. It is true that the field of the immersion heater is not universal—there are many cases where it cannot be used—but in its own field among those applications to which it is fitted it will secure us business that we could not otherwise obtain, and will render satisfactory and economical service to its owner when properly installed. It deserves a wider development and use than has so far been accorded it.

Various Methods and Efficiencies

The immersion heater is the last of the six methods of heating liquids by gas. For every application or process that we meet in the course of our work we must choose one of these six fundamental types. In order that we may choose wisely and correctly we must understand the strong and weak points of each system, its particular advantages and disadvantages for different kinds of work and operating conditions, and the efficiencies that may be obtained from each under practical working conditions.

The curves shown in Fig. 1 may prove useful in making estimates of gas consumptions and costs for various applications They show the gas consumption necessary to heat 1 gal. of water 1 deg. Fahr. for gas of three different calorific values at various efficiencies of application. The gas consumption for temperature increases other than 100 deg. can be readily found by multiplication.

For use in connection with these curves we give below a statement showing the range of efficiencies that may reasonably be expected from various methods of heating under normal operating conditions:

Open vessel over open burner, as on range	20—35%
Atmospheric burners under open tank or cauldron, brick setting or enclosed by a skirting	30—40%
Small tank heaters, straight flow efficiency	65—80%
Small tank heaters with tank, efficiency of system based on heat in water delivered at point of use	50—65%
Large automatic storage systems, heater, tank and circulating pipes properly covered, efficiency of system based on heat in water at point of use	65—80%
Instantaneous heaters, straight flow efficiency	75—83%

Instantaneous heaters, efficiency of system based on heat in water delivered at point of use.....55—75%
Indirect system, gas-fired steam boiler, supplying coil in water tank, heater, tank and pipes covered, thermostatic control, system of efficiencies based on heat delivered in water at point of use .....50—60%
Immersion heaters .....60—70%

Water Heating as Summer Business

No article dealing with the application of gas to the heating of liquids can be complete without some consideration of the possibilities of summer load. The importance of this phase of the subject cannot be too strongly emphasized. In most communities all things conspire to create a larger use of gas in winter than in summer. The days are shorter, therefore more gas is used for lighting; people eat more hot foods, drink more hot beverages; they use more hot water, which, being colder, takes more gas to heat each gallon; many people are away from the city in the summer; many houses are closed for weeks, or even months; besides, and above all these, we have the space heating, with its ever-increasing demands upon our winter sendout. All this means that gas companies need business that will be active in summer and off in winter; need it badly, and will need it more and more as gas comes more and more to be the only household fuel. On the other hand, many factories, hotels, apartment houses, office buildings and stores heat their water from large heating boilers in winter, but have no convenient way of obtaining it in summer. To run a large boiler and keep a fireman to make steam to heat a comparatively small amount of water is obviously inefficient and may cause a very serious increase of heat in parts of the plant in warm weather. Even if a small coal boiler is used, someone must look after it and service is often poor. The needs of the gas company for summer load and of the customer for summer water heating meet and are satisfied in the gas-fired heater.

The writer recently investigated a case where a manufacturer was operating a 150-h.p. boiler at high pressure, employing a licensed fireman and keeping a large system of steam pipes hot all summer. This work could be easily handled by the installation of a 12-h.p. gas-fired boiler, a water heater and two large burners in a dry-room; the cost of the gas equipment and the necessary changes would be less than $1,400, and a saving of more than $700 per season would be effected, besides making the plant much more comfortable. In another plant, a 75-h.p. boiler will be shut down during the summer by the use of two immersion heaters; here the first cost is very low and a handsome saving will be effected.

What broader or more attractive field invites the application of gas to-day than the heating of liquids? Nearly all commercial and industrial enterprises must have hot water in greater or less degree for some purpose, and besides water there are the acid and alkali solutions to be kept hot, milk to be pasteurized and a host of other needs to be met. Up to the present time the gas industry has been too prone to content itself with the smaller applications; but the larger uses are even more profitable and desirable, though not so easily secured. For these large applications the cost of gas often looks high in comparison with other fuels, but gas can do what other fuels cannot; when automatic control, cleanliness and flexibility are properly capitalized, it will usually prove cheapest in the end.

To secure and hold this most desirable load furnished by the larger applications and processes, the gas industry must have good appliances, reasonable rates, and, above, all, engineer-salesmen who can secure the confidence of the prospective customer and then proceed to select and install the proper system with the best appliances in the proper way. Efficient and economical results must follow to the mutual satisfaction and profit of the gas company and consumer.

Venturi Tubes and Orifices for Bulk Gas Measurement

With Special Reference to British Practice

By MAJOR JOHNSTONE-TAYLOR, Shrewsbury, England

While the drum type of meter for dealing with large gas flows is well known to gas engineers and others as being reliable and accurate, in large sizes it becomes very heavy and expensive.

To overcome these shortcomings the Venturi system has now, after considerable experiment, been adapted to this system of gas measurement with considerable accuracy.

The Venturi principle of the variation of pressure in a pipe of the fluid flowing therein in proportion to the velocity of flow of that fluid has been understood for a very long time, but it remained with an American engineer, Clemens Herschel, to put it to practical use. This was first done some thirty years ago in connection with water measurement, and the Venturi water meter, which is mainly used for large flows, is now universally installed.

Principle of Action

For the benefit of those readers who are unacquainted with the Venturi principle as applied to measuring the flow of liquids and gases the working thereof may be summarized as follows:

Referring to Figure 1, the Venturi meter consists of two conical tubes 1 and 2 joined together at their small ends and inserted in the line of pipes P P_1. The large end of each of these conical tubes has the same internal diameter as P P_1 and the small ends are of the same diameter in both tubes, the exact diameter

at "a" varying according to the average duty of the meter.

It has to be very accurately determined and formed.

The direction of flow is shown by the arrow. There are two small tubes 3 and 4 connected where shown. The pressure in tube 3 will be greater than that in tube 4, owing to the greaeter velocity at the point a due to its reduced area, this difference of pressure at any instant is a direct and accurate indication of the flow of liquid or gas from P to P_1.

As will be shown later, this difference of pressure is caused to operate the recording mechanism.

Special Considerations When Applied to Gas Meters

Unlike water or air, commercial gases are very liable to cause deposit in Venturi tubes. This difficulty is overcome by providing a heater on the throat section of the tube (see Fig. 2) for use during cold weather and by making the inside of the tube easily accessible for inspection or cleaning.

Another difficulty that has been overcome is that

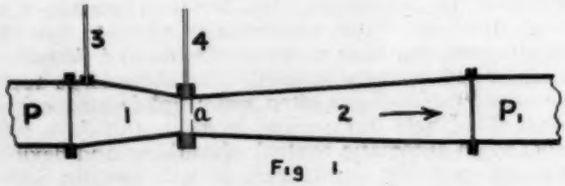


Fig 1

due to the fact that commercial gases have no definite weight per cubic foot at any given pressure and temperature, owing to variations in the "make." This at first caused considerable difficulty in the case of the Venturi gas meter, whose registration depends on the square root of the density of the fluid passing through it.

To overcome this two types of recorder have been developed, the "A" or station-type recorder, which automatically takes into account every variation in the specific gravity of the gas and registers volume precisely the same as the drum and rotary types of meter do, and the "B" or District type of recorder, which has a rather smaller range than the "A" type, and which, instead of automatically taking into account the variations of specific gravity, is used with a conversion table. The "B" type, which can be used for measuring high-pressure gas, is considerably cheaper, and as the errors due to specific gravity are not large it is in many cases entirely satisfactory.

Installation

The Venturi tube, which is illustrated in Figure 2, consists of a gradually converging upstream cone a, a short parallel throat section b and a very gradually diverging downstream section c. The latter serves to reduce loss of pressure to a minimum. The throat b is steam jacketed to prevent deposit, the pipes for this purpose being shown at e.

This arrangement serves to eliminate the deposit of such substances as Naphthalene. The section b is made easily removable for cleaning, however. Owing to the smooth contours of the Venturi tube, there is little liability to eddy flow through it, a fact which

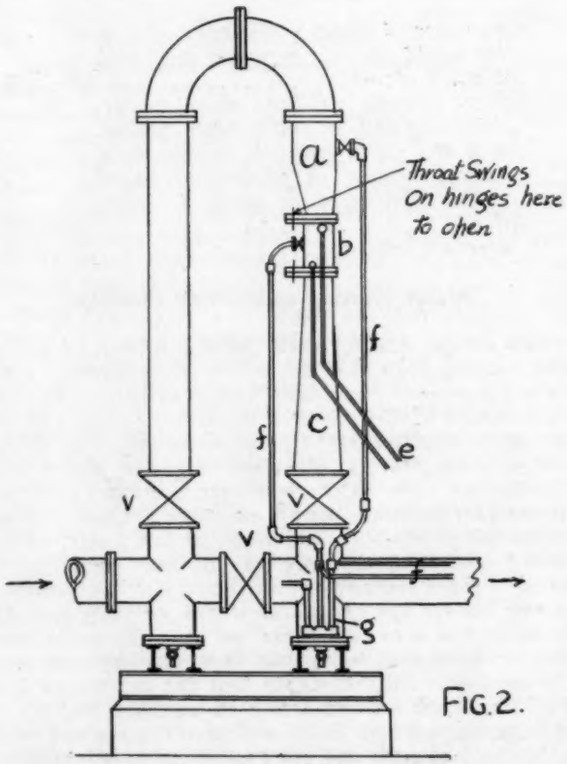


FIG. 2.

reduces the tendency to deposit to a minimum, which is assisted by the high velocity therein and accurate machining of this part of the meter.

Figure 2 shows the vertical method of installation, which takes up small floor space and has a tendency to reduce deposit. It is generally preferred, but the whole apparatus shown may be equally well installed in a horizontal position.

There are three valves v v v, the purpose of which is obvious: the small pipes f lead to the recorder, while g g are drainage syphons.

Recorders

The "A" Type.—This type of recorder is connected to the Venturi tube by means of pressure pipes and may be placed at any convenient distance away, say 300 ft., provided that the pressure pipes are at least ¾ in. in diameter, laid at a sufficient slope to drain and fitted at their lowest points with drainage syphons.

The recorder registers by counter and diagram the actual volume of gas which has passed, measured at the temperature and pressure which exists at the Venturi tube. The counter mechanism will commence to register at 1/20 of the full flow, and the meters are designed to register within 2 per cent between 1/10 full flow and full flow. To enable this high accuracy to be maintained in practice the meters must be designed so that every part can be inspected and checked in situ, the Venturi tube being installed on a by-pass (see Figure 2) and the throat section being made easily removable for inspection and cleaning.

The principle on which this type of meter works is based as follows:

The volume of gas passing through a Venturi tube is directly proportional to the square root of the difference of pressure between the upstream and throat portions of the tube, and inversely proportional to the square root of the density of the gas passing. In the recorder a sensitive bell measures the difference of pressure above referred to and a shaft whose speed (about thirty revolutions per hour) is made inversely proportional to the square root of the density of the gas passing, adds to the counter each time it rotates an amount proportional to the square root of the differential pressure measured by the sensitive bell referred to.

Thus the actual volume of gas passed is shown by the counter record. This type of recorder can be

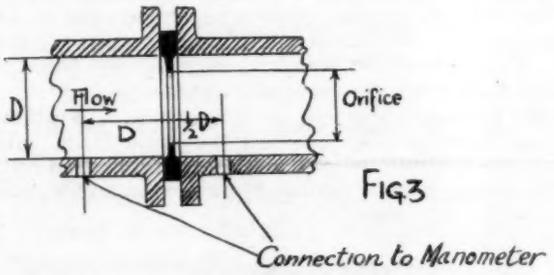


FIG3

used with orifice fittings. These will be discussed later.

The "B" Type.—This recorder is designed for general use with a Venturi tube or orifice. It consists of an inverted bell, enclosed in a bell chamber and sealed by oil. The upstream pressure is brought to the underside of the bell and the downstream pressure to the inside of the bell chamber. Any increase of pressure, therefore, causes the bell to rise.

The motion of the bell is taken out through the wall of the bell chamber by means of a spindle rotating in a gland, thus reducing the friction opposing the motion and the consequent "lag" between the up and down readings to a minimum. The bell is compensated for temperature changes, while its motion may be damped if the flow is slightly pulsating. Thus steady pen reading may be obtained. All cocks and pipes leading to the pressure bell must be of ample size, so as to avoid danger of surface tension films of condensed moisture holding up the very small pressure differences to be transmitted.

This recorder may be placed at a distance, under the same conditions as the "A" type. The diagram may be either of the disk or cylindrical pattern.

The latter, which is rotated once in twenty-four hours, is generally used for recording intermittent flows. A diagram only or counter only or both may be installed with the recorder according to choice. Where a diagram only is installed, for the sake of economy, it can be integrated by a planimeter.

The counter mechanism of the "B" type consists of an enclosed eight-day clock train which causes a spindle carrying a cam to make thirty revolutions per hour. The counter is driven off this spindle. A "style," whose position is set by the flow mechanism, determines, by the points at which it is lifted and dropped by the rotating cam, what amount is added to the counter train at each revolution. By this means a counter record of the flow passing is obtained. This recorder works on a pressure difference of two inches.

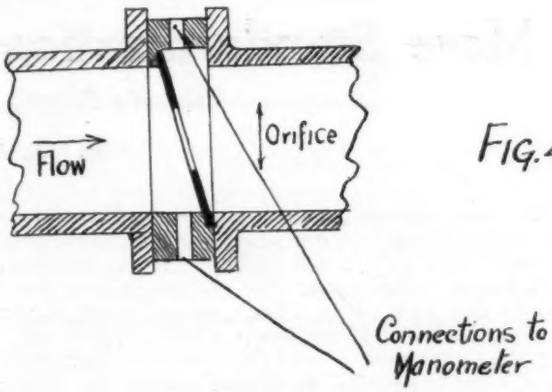


FIG.4

For small plants, where a Venturi installation would be a heavy item of expense, and for several other purposes, the orifice method of gas measurement is simple, fairly accurate and offers some advantages.

The best known of these is the plate orifice.

This consists of a thin plate interposed between two flanges of the gas main as shown in Figure 3. The two adjacent pipes are then connected to a manometer by small tubes, usually of copper. These manometers are comparatively simple instruments and depend for their working upon the movement of a column of liquid in a "U" tube.

The movement, or rather varying position of this column of liquid depends upon the differenc of pressure that exists, by reason of the plate, on each side thereof, and as this in turn is proportional to the flow through the hole in the plate or orifice, the position of liquid in the "U" tube is a direct measure of the rate of flow.

The plate and its connections can be made by any good mechanic, the manometers being obtained from several instrument makers, who sometimes will supply the orifice plates, etc., also. The curved tube pattern is very suitable for the purpose of gas measurement, and will be referred to again.

To return to the orifice, this requires to be of an area properly proportioned to the average flow and to be accurately formed. It really forms part of the instrument and is best made by the instrument makers.

They vary in size from one inch to thirty inches and, as shown in Figure 3 take the form of thin plates with an accurate hole. The exact size of this hole is a matter for calculation. Apart from this pattern, which, as shown, is fixed between two flanges and requires the adjacent pipes to be drilled, a plate orifice can be made up in such a form as to do away with this drilling for the nipples. The whole arrangement thus forms a complete unit which can be bolted up between the flanges, as shown in Figure 4.

In this case the plate has to be made to slant slightly in order to give a clear entry to the pressure holes, which is important. It is equally important that these pressure pipes should have a regular slope and be fitted with drainage syphons. Sharp bends must be avoided.

(*Continued on page* 144.)

More Standardization and Publicity Needed

Babson's Report Starts a Discussion

By J. E. BULLARD

The other night a group of gasmen and appliance men were talking together when someone mentioned the report that Babson had made on the gas business. That started a discussion. For various reasons these men do not wish to have their names made public but what they had to say seems worth passing on.

In the first place it was brought out that there seems to be a general impression among the public that the possibilities of house heating by electricity are greater than they are by gas. One of the men told how he had not been able to persuade a friend of his that houses would be heated with gas much sooner than they would be by electricity. He pointed out to this friend that when coal is used for generating electricity some 85 per cent of the heat value of the coal is lost before the current reaches the heating appliance and that there seems to be no way of preventing this great loss. In the making of gas, on the other hand, there is a smaller, a very much smaller, heat loss and, in addition, there is the recovery of a great many valuable by-products, by-products that are needed for making fertilizer, dyes, medicines, perfumes, good roads, motor fuel and many other things that the people need.

The public, and even some gasmen, do not realize that the time will probably come when the fuel used for generating electricity will have to be gas and coke. Even Mr. Babson, a professional statistician and collector of reliable information, failed to realize this.

Yet in various parts of the world experiments have actually been carried on towards the end of using no raw coal in electrical generating plants. There is just one reason for this in the opinion of these men. That is, the people have been told the rosy side of electricity. They have not been told very much about gas. They have been led to expect the impossible from electricity. They haven't been made to realize the possible from gas.

The newspapers, magazines and trade papers in all fields give a good deal of space to electricity, while gas is rarely mentioned except in connection with the dangers connected with it and its limitations. One thing that the gas industry needs, then, is much more publicity in regard to its advantages, the way to use it and its great possibilities. Something along this line is already being done but a great deal more is necessary. It would seem to be a good plan to supply all writers, all people engaged in research and all editors with just as much up-to-date information and data concerning the gas industry as it is possible to supply them. Educate these people and a long step will be taken in the education of the public.

But, it was pointed out, it is going to be a hard thing to educate the people until there is more standardization in gas. To-day the appliance man finds that gas pressures vary anywhere from one inch to seven inches. There no longer seems to be any standard. Under such conditions it is almost impossible to manufacture appliances that will give entirely satisfactory service. If they are satisfactory in one city, they will not be satisfactory in another until changes are made.

Again there is a great variation in the heat value of gas. In one city it may be as low as 450 B.t.u. In another it may be over 600. In some cities, so these men claimed, the heat value is kept down just as low as it can be and still get past the inspector. It may even be below the standard required by law. At least, it doesn't go above this standard.

As a result a gas rate no longer means anything. If all manufactured gas had the same B.t.u. value then a cubic foot of gas would mean a certain number of heat units. To-day it may mean any number between very wide limits.

Voltage Standardized

In the electrical industry the voltage has been pretty well standardized. For domestic use 110 volt, single phase, sixty cycle current has become standard except in the centers of some cities where direct current is still supplied, and in some cities where 104 or 115 volts has been adopted. There are also a very few places where 250 volts is still used to a limited extent and farm power and light sets may give but 32 volts. On the whole, however, the standard for electric lighting is 110 volts with 220 volts for power and 2,200 volts delivered to the transformers of the large consumers.

The pressure of electricity, in other words, is standardized. It is not standardized in the gas industry, and this makes it difficult for the appliance men to make appliances that will give the very best and the most efficient service. This in turn leads to dissatisfaction with gas and increases the difficulty of selling it.

Even if the voltages in electricity were not standardized, the electric rate would mean something. It would indicate how large a consumer's bill would be. It makes little difference whether the voltage is 104, 110, 115, 220, 250 or 500, the electric rate indicates how high the monthly bill will be. The electric rate is based upon the kilowatt; that is, the product of the amperes times the voltage. A kilowatt always has the same B.t.u. value. Therefore, electricity is actually being sold on a B.t.u. basis. If a person wants to cook with electricity, to heat with electricity or to use it in any other way, all he has to do is to find out how many B.t.u. will have to be supplied to the appliance, find out how many kilowatts per hour it is necessary to use to supply these B.t.u. and then what the rate is per kilowatt hour. This will give him the cost of using electricity and, no matter where he may be located, he will be able to ascertain the cost from the electric rate because the rate is in B.t.u.

(*Continued on page* 144.)

As the Journal Views It

American Gas Association
342 MADISON AVENUE
NEW YORK CITY

August 11, 1922.

AMERICAN GAS JOURNAL,
53 Park Place, New York City.

Gentlemen:

In answer to your inquiry I would advise that the publishers of the "American Gas Journal" as well as the publishers of other journals established in our industry will have full opportunity to distribute copies of their journals at our Annual Convention on the Steel Pier at Atlantic City during the week of October 23-28.

Very truly yours,
(Signed) OSCAR H. FOGG,
Secretary-Manager.

OHF.S

The American Gas Catalog and Directory

Sufficient time has elapsed since the first edition of the American Gas Catalog and Directory was issued to be able to form an opinion regarding its service to the gas industry. From the fact that its reception has been so very cordial it is evident that, to use a hackneyed and time-worn phrase, "it fills a long-felt want."

Since the publication of the catalog and directory many letters have been received from delighted gasmen in various sections of the country, all of whom state that there is a real place for such a book.

It was with some trepidation that this work was undertaken, for its gigantic size was thoroughly realized, but now that it has been placed in the hands of practically the entire gas industry and the expressions of opinion have been received plans are being formulated for an even greater edition in 1923.

But the opinions of the publishers are worth little unless they are backed up with those of the field that is served. That is the reason that the AMERICAN GAS JOURNAL is proud of the opportunity to quote such communications as the following:

"I received a copy of your American Gas Catalog and Directory for 1922, and as a combination of gas engineering data and gas catalog, it is surely the best thing that has ever been published in this country.

"(Signed) D. F. BURRITT,
"Middle West Utilities Company."

"This is one of the best books that I have had the pleasure to add to my collection and cannot see how any gasman can very well be without it.

"(Signed) ALFRED FOWLER,
"Superintendent, Salem Gas Light Company,
"Salem, N. J."

"We are very much pleased with the appearance and contents of this book (the American Gas Catalog and Directory) and expect to find it of a great deal of service in the coming year. We appreciate very much the work of the JOURNAL in offering this new service to the gasman and wish you every success in your activities.

"(Signed) CHARLES A. HARRISON,
"Superintendent Gas Department,
"Salina Light, Power & Gas Company,
"Salina, Kan."

These are only a few of the many expressions that have been received but they show that the work of the AMERICAN GAS JOURNAL is appreciated. It has ever been the ideal of the JOURNAL, one of the oldest trade publications in the world, to render real service to the industry which it has the honor to serve, knowing that its reward would be sure to follow if its service was worthy.

While it is contrary to the policy of the AMERICAN GAS JOURNAL to make promises of its future activities it can be said that the plans that are being made for the second edition of this work are exceedingly pretentious and the spirit that is in back of the work will, we feel sure, carry it to a successful conclusion.

The AMERICAN GAS JOURNAL wishes to express its deep appreciation to those who encouraged it to make this effort.

The La Follette Committee

The La Follette Senate committee which has been appointed to inquire into the oil situation in the United States is evidently going to go on a fishing expedition so far as gas companies are concerned. This is indicated in recent dispatches from Washington and also in information which has come to the AMERICAN GAS JOURNAL. According to the information at hand, the attempt is going to be made to tie up some of the larger companies in the industry with numerous of the oil-producing concerns.

The effort will produce, undoubtedly, a great deal of copy for a certain class of newspaper throughout the country, not so much of the actual facts brought out as on the type of question that will be fired at witnesses who will be called before the committee and grilled.

The gas industry has nothing to fear from any investigation, and it most certainly will welcome any steps that will eventually result in a reduction of its cost of raw materials; but there most certainly is no need for any such investigation as that which is planned.

To us this branch of the inquiry means simply that the legal expense of the gas company, which unfortunately is eventually paid by the public we serve, will be greatly increased, and we are not sanguine of any particularly beneficial result. However, the fall elections will soon be on us, and it is going to be necessary for some kind of material to be supplied. It is our hope that some of the Senate leaders will realize how futile will be the investigation and that they will save thousands of dollars to the taxpayers by halting the investigation, and they will also save thousands of dollars to gas consumers by not making it necessary for us to defend ourselves against absolutely baseless charges.

Venturi Tubes and Orifices for Bulk Gas

(*Continued from page* 141.)

The Curved-Tube Manometer

Most engineers are familiar with the ordinary "U" tube, which needs no description here. One of the difficulties of producing an easily-read manometer of the ordinary "U"-tube pattern is that as the flow varies as the square root of the pressure difference the scale for low rates of flow is very cramped.

The curved-tube manometer gets over this difficulty by curving the tube so as to obtain an equally-spaced scale from about one-tenth of the maximum scale upwards.

It provides an accurate and easily-read rate of flow indicator for use with the Venturi tube or orifices at comparatively small expense.

Curved-tube manometers can be had to work at four different maximum pressures from ½ in. to 4½ in. of water, and are suited for use with Pitot tubes for temporary work and for orifices used to measure high-pressure gas.

Accurate readings down to one-eighth of maximum flow can be obtained with the ordinary pattern and down to one-sixteenth maximum flow in a special long-range form.

These instruments have the special feaure that there is no appreciable variation of the zero point with temperature changes, a feature not always obtainable with other "sensitive" manometers.

These manometers are usually made of celluloid. This material is, however, unsuitable for use with gas containing much ammonia. Glass tubes have then to be used. It should be noted, however, that if broken the instrument must go back to the maker's works for calibration, hence the use of celluloid wherever possible.

More Standardization and Publicity Needed

(*Continued from page* 142.)

With gas it is different. Before being able to estimate the efficiency of the appliance it is necessary to know what gas pressure will be supplied. The same appliance will not show the same efficiency under all conditions of pressure, and the highest pressure of the gas supplied may be 250 per cent higher than the lowest pressures found.

Then another factor enters to complicate complicate matters. The highest efficiency of any appliance is gained at a certain pressure with gas of a certain quality. The quality of the gas varies anywhere from 450 to 600 or more B.t.u., so how are you going to be able to determine the efficiency of the gas in advance?

As a result, gas rates don't give a very good indication of what the bill may be. A comparatively high rate in one city may mean a lower bill than a consumer getting the same results in another city gets from gas sold at a lower rate. A thousand cubic feet may mean anything from 450,000 B.t.u. to 650,000 B.t.u., which used in standard gas appliances will give either a low or a high efficiency.

Everything else that is sold is sold on a basis that indicates what the people are going to get. It is not necessary to make elaborate tests and make very complicated mathematical calculations in order to determine what one is getting. Buy a peck of potatoes, and if the dealer from whom one buys them is honest one gets a peck. A little examination will show whether or not those potatoes are good. The milk we buy has to meet certain uniform standards and be full measure. Practically the only thing that is sold like a pig in a poke is gas.

These men could see but two ways of solving the problem. One was to adopt a country-wide standard for B.t.u. value and for pressure. The other is to discontinue the practice of selling gas by the cubic foot and to adopt the practice of selling it by the B.t.u. Even then if the best results are to be obtained it is going to be necessary to have the gas meet certain standards in regard to B.t.u. and pressure and to have these standards uniform. If they were uniform better gas appliances could be built, higher efficiencies could be obtained, and it is even possible that the appliances could be made at less cost.

Anyone who doesn't look beyond the present chaotic conditions in the pressure and B.t.u. practice among gas companies could hardly draw any other conclusion than that the gas industry is on its last legs. It is certain that no other legitimate business is being conducted on the same basis as the gas industry. There is no other using a sales unit that doesn't mean anything. It doesn't matter whether a man buys an auomobile in New York, Chicago or San Francisco, he knows what he is going to get if he buys a new machine. He is going to get a whole automobile, including top, windshield, wheels and all. If he moves from one town to another, however, he doesn't know what he is going to get for a cubic foot of gas. As a matter of fact, he may have to have several readjustments and some changes made in his appliances before he can use it at all in a satisfactory manner.

The men who took part in this discussion are not disloyal to the gas industry. They have no doubts in regard to its prosperity in the future.

Developments in Gas Technology

Important Information Gathered from All Parts of the World

By ISMAR GINSBERG, B.Sc., Chem. Eng., Associate Editor

Purification of Coal Gas

Amorphous charcoal, such as is obtained from anthracite coal, will absorb and remove from coal gas carbon disulphide, carbon oxysulphide, thiophene and other organic sulphur compounds. The absorptive power of the charcoal may be improved by dehydrating the material by chemical means either before or after carbonization. If it is not desired to remove ethylene and other hydrocarbons, the quantity of charcoal is limited. (See British Patent No. 178,510.)

Swelling of Coke

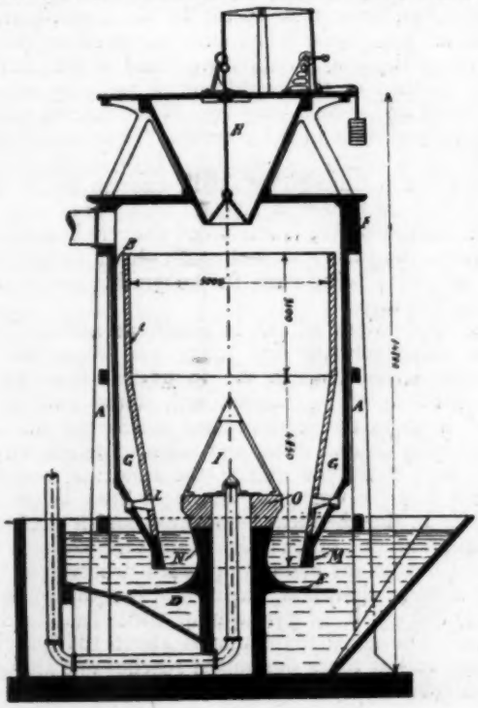
In the coking of coal, the coal swells and the volume of coke is greater than that of the original coal. A method for determining the degree of swelling is described in *Brennstoffe Chemie*, 1922, pages 97-98. Two pieces of coal, each of about one cubic centimeter volume, are weighed. One is dipped in melted paraffin, and its volume ascertained by immersion in a measuring cylinder filled with water. The specific gravity is calculated from the weight and volume of the coal. Then this figure is used to determine the volume of the second piece of coal. The second piece of coal is coked in a crucible in the same manner as for proximate analysis. The coke obtained is dipped in paraffin and its volume is determined. Other investigations are being made to determine the influence of the rapidity of heating on the swelling in coking.

Protective Progressive Distillation

The apparatus, described in British Patents Nos. 177,556 and 177,559, is a combined retort and generator, which forms a part of a plant for the distillation and gasification of carbonaceous matter and recovery of ammonia in which, in order that the distillation shall be effected completely in the retort, the temperature of the latter is progressively raised from the top downwards to a maximum value of about 1,300 deg. Cent. This is accomplished by surrounding the retort with flues, which are traversed by the products of combustion of some portion of the producer gas generated in the generator or by the gases from the recovery plant after removal of the ammonia and hydrocarbons. The secondary air is heated by the waste gases from the retort flues, and superheated steam is supplied to the generator and retorts by a boiler and superheater. The lower ends of the vertically arranged retorts communicate by funnel-shaped chambers with the upper end of the generator. The coke passes through the chamber without the admission of air. The retorts are separated from the generator and placed alongside it. The coke from the retorts is fed to the hopper which is found at the top of the generator. Boric compounds are added to the fuel.

Reinforced Concrete Gas Producer

The reinforced concrete gas producer, which is shown in the accompanying diagram, was constructed for experimental purposes in Florence, Italy (see the *Gas Engineer*, 1922, pages 165 and 166). The body of the producer is made of reinforced concrete of inverted bell shape. This is suspended from the rings F which rest on the legs A. The lower part of the bell is provided at the bottom with a reinforced concrete ring M, on which the refractory lining of firebricks C is placed. In order to equalize the heat transmitted to the concrete bell, the space G between the firebricks and the reinforced concrete bell is filled with light perforated bricks. The concrete base N is located in the center of the lower



opening of the bell. This rests on the main foundations at the bottom of the water-seal tank. A conical grate I is fixed on this concrete base. This is separated from the concrete by a layer of refractory brick O.

The pipes for leading air and steam into the apparatus are passed through the part N, which is made hollow for this purpose. The circular tray D, attached to the base N, catches the ashes as they fall from the grate. A hydraulic device is brought into action to remove the ashes and make them fall into the water tank below. A bucket conveyor removes the ashes from the water tank.

This producer was put into actual service to supply gas to a Babcock boiler of 600 square meters heating surface. To perform the work its normal consumption of lignite amounted to eight tons per hour. On over-

load the apparatus was worked at the rate of from ten to eleven tons per hour. The apparatus was subjected to an explosion test by cementing down an iron plate on the safety valve of the generator. The explosion blew the 132 lb. plate about twenty meters, but did not injure in any way the concrete bell. A temperature test was made by withdrawing all the water from the water tank and burning lignite for twelve hours in the generator. The flames were escaping from the top when the temperatures were measured. At the top this was 300 deg. Cent., and the bell was 160 deg. Cent. at the hottest part. Under normal running conditions the bell does not attain a higher temperature than from 20 to 30 deg. Cent. above the atmospheric temperature, while the top of the apparatus reached a temperatutre of 60 deg. Cent. The economy in initial cost of construction in comparison with the metallic generator is over 50 per cent. The maintenance of the apparatus is very small and an appreciable saving is effected therein as well.

Radio Device Big Factor in Use of Gas

Gas is an important factor in the manufacture of telephone apparatus. The heat required in the production of the delicate apparatus used in the communication systems of the world and in radio broadcasting equipment makes necessary two of the largest privately operated gas tanks in the country. They are owned by the Western Electric Company, which in its manufacturing plant at Chicago uses daily enough gas to supply a city of from 80,000 to 100,000 inhabitants. This immense amount of gas is consumed entirely in productive operations requiring exceptionally high temperatures, none whatever being used for generating power or for heating buildings.

The applications of gas in telephone and radio telephone manufacturing are many and diversified. It heats the large ovens in the foundries; it softens the glass used to make switchboard lamps and vacuum tubes; it heats the lead presses which put the heavy lead coating around miles and miles of telephone cable every day; it softens iron in the annealing ovens and hardens it in the tempering ovens; it heats beakers and crucibles in the chemical laboratory, and it performs a thousand and one other tasks in the big works.

The Chicago gas plant is operated twenty-four hours a day in three eight-hour shifts, and is equipped to send out 135,000 cu. ft. of gas an hour under peak-load conditions. The usual maximum is about 105,000 cu. ft. an hour, and at times the output reaches one and a half million cubic feet per day.

Denver Mourns for Frank Frueauff

Denver, Col., was rocked as if by an earthquake when the news was flashed that Frank Frueauff, president of the Denver Gas & Electric Light Company, had died suddenly.

It was just thirty years ago that Frank Frueauff, a seventeen-year-old boy, graduated from the Denver High School, made application for a position to the late William J. Barker, head of the then Denver Consolidated Electric Company, and was employed as a meter reader and lamp clerk. Twenty years later, during which time he had served in various official capacities, he was elected president of the company, holding this position at the time of his untimely death, aged forty-eight years.

He was known as the "Champion Director," being a director in 141 concerns; and since 1905, when he joined partnership with Henry L. Doherty, constituting the "and company," he was instrumental in operating 225 public utility properties. In addition to this, he was active in many technical societies. Some of the principal concerns of which Mr. Frueauff was an official, in addition to the Denver plant, are: The Western Light & Power Company, the Pueblo Gas & Fuel Company and the Summit County Power Company, all in Colorado; the Toledo Railway & Light Company, the Empire Gas & Fuel Company, of Bartlesville, Okla.; the Crew-Levick Oil Company, the Empire Electric Company, of Joplin, Mo., and the Ohio Public Service Company, at Cleveland.

In speaking of Mr. Frueauff, Clare N. Stannard, vice-president and general manager of the Denver concern, said:

"Mr. Frueauff had learned the knack of bringing the public and the public utility interests together on a friendly, workable, mutually profitable basis. I had known Mr. Frueauff for more than twenty-five years. I had always looked on him as one of the finest men I have ever known, both in a personal and business way. He was a man of mighty integrity and lofty ideals. I feel not only that I am losing a dear friend but that all of his employees and the city of Denver, too, are losing a friend tried and true.

"He often told me that one of the hardest things he did in life was to leave Denver. He ever maintained a high regard for the city where he had his beginning. The ambition nearest his heart was to return here to make his home.

"His devotion to Mr. Doherty and his value as an executive were remarkable, and his death is a severe blow to the New York family. Although Mr. Doherty has made it a business that every man in his employ, no matter how important or unimportant his position, should have an understudy, the void left by Mr. Frueauff's death will be hard to fill."

The writer is in accord with all that Mr. Stannard says and, while deploring the untimely death of Mr. Frueauff, cannot refrain from calling attention to the fact that his life exemplifies that of a self-made man and disproves the charge that only "pull" can win. There is also extant within the writer's mind that Frank Frueauff worked himself to death, and although he made good with the numerous ventures he tackled, he undertook too much. He was tired, but his zeal would not permit him to stop and think of that.

Germany's Gas Production

The annual report of the Economic Association of German Gas Works shows a notable increase in gas-coke production over 1920-1921. Gas generation, gas-coke, tar and ammonia products output since 1913-1914 follows:

	Gas (Million Cu. M.)	Gas-Coke (1,000 (M. Tons)	Tar	Ammonia
1921-1922...	1,768.9	655.7	137.9	95.9
1920-1921...	.....	488.4	129.3	103.2
1919-1920...	1,831.2	369.8	122.7	89.1
1918-1919...	1,928.6	690.5	193.1	85.1
1917-1918...	1,884.4	357.6	205.5	83.8
1916-1917...	1,757.0	656.5	176.6	81.2
1915-1916...	1,612.2	635.9	158.4	57.1
1914-1915...	1,610.7	523.4	124.0	51.6
1913-1914...	1,612.7	485.8	104.6	43.7

Coal Situation Depends on Railroad Strike

U. S. Chamber of Commerce Discusses Dispute

Washington, D. C.—The addition of 100,000 men of equal producing efficiency to those now mining coal, if favorable conditions obtain, would mean that the bituminous coal needs of the country would be met, according to the Coal Bureau of the Chamber of Commerce of the United States, which has issued a detailed review of the fuel situation.

The bulletin was put out to the membership of the chamber for the purpose of informing it as to coal supplies and the outstanding issues involved in the controversy between the operators and the miners.

The Coal Bureau bases its opinion regarding the number of men required to bring about a return of normal bituminous production on figures showing that with 610,000 men on strike and 185,000 at work the mines produced in the week ending before the shopmen's strike began 5,337,000 tons of coal as against the country's weekly requirements of 8,100,000. At the same time the bureau calls attention to the fact that production has fallen off in the last three weeks due to the railroad strike and that any prediction having to do with coal output must take into consideration the railroad situation.

As to the anthracite situation the Bureau says that as it is customary to operate anthracite mines in summer to build up winter stocks the shortage is causing concern and that some substitution of bituminous for anthracite is likely. There are no reliable figures, says the bureau, as to the amount of anthracite stocks on hand.

There are positive indications, says the bureau, that certain industries in various parts of the country have reached an end of their bituminous resources.

A development of the strike which has caused much concern, it is declared, is the interruption of the delivery of coal at Lake Erie ports for shipment to the Northwest. It is pointed out, however, that the requirements of the Northwest can be met if beginning Sept. 15 or possibly as late as Oct. 1 coal can be delivered in volume of at least 1,000,000 tons a week until cold weather closes navigation.

Wage Question Not Main Issue

In its explanation of the issues involved in the strike, the Coal Bureau declares that the question of wages is not the main issue and that the chief point at issue is the difference over the basis upon which the operators shall deal with the miners, both as to wages and conditions of work.

"From the beginning," says the bureau, "the United Mine Workers have contended for negotiations upon a national basis. The method for carrying this out is agreement between operators and mine workers as to wages and conditions in what is known as the central competitive field, comprising the mining districts in western Pennsylvania, Ohio, Indiana and Illinois. Wages and conditions in other fields throughout the country would be adjusted in accordance with the agreement for the central competitive field. The operators, on the other hand, in view of different mining and living conditions, contend for separate working agreements by districts, or at most by States.

"The mine workers have refused and are still refusing either to confer or to consent to arbitration upon anything less than a national basis. This is evident from reports as to efforts by governors following the appeal to them from the President to bring about conferences between mine workers and operators by States. The mine workers, wherever this is being attempted, refuse to confer because of the stand made by the United Mine Workers of America, for a national basis of adjustment.

"Closely related to the desire of the United Mine Workers to preserve the central competitive field as a basis for national wage agreements is the policy of the United Mine Workers in urging complete unionization of the coal industry.

"Another factor in controversy, which holds higher place in importance with both parties than the wage schedule, is what is known as the 'check-off.' This is an arrangement whereby union dues and all union assessments are collected from the miners by the operators through the simple process of withholding such dues and assessments from the pay envelopes. The contention of the operators is that this arrangement has enabled the miners to accumulate larger sums than they could otherwise have accumulated, which have been used for the unionization of the industry and the maintenance of strikes. The miners contend that the check-off is a legitimate means of collecting dues and is based on long practice which originated in England.

"There are no figures available showing the total income of the United Mine Workers of America through the medium of the check-off. According to statements of Mr. Brophy, president of the Central Pennsylvania Union District, at congressional hearings, and figures for the Illinois, Kansas, Missouri, Oklahoma and Arkansas districts, $3 per month is approximately the amount paid by individual members. Assuming the number of paid-up members of the United Mine Workers to be 425,700, which were the figures of 1921, this would represent an approximate income of the organization per year of $15,500,000. Mr. Brophy's figures indicated that of the amount collected in his district approximately 45 per cent paid out by the local unions as wages to check weighmen, employed by the unions to verify the weights of coal paid for by the ton. The same basis of calculation if applied to the entire organization would require a reduction from total income of approximately $7,000,000. The organization's income is also drawn upon for out-of-work relief and death benefits.

"President Harding's proposal at the Washington conference was that the miners should return to work at the March 31, 1922, scale pending a readjustment of wages. Certain of the operators who did not accept the President's proposal to arbitrate the wage scales suggested the miners return on the lower wage scale of Nov., 1917, this being the scale set by the Fuel Administration during the war.

"It is difficult to establish a basis for a comparison of wages, not only in the coal industry itself, but with other industries. In the anthracite field, on March 31, just prior to the strike, the wages for inside day labor averaged $4.76 per eight-hour day. The present demands of the miners in the anthracite field which were ratified by the conference of the United Mine Workers of America at Indianapolis, Feb. 14, 1922, call for a flat increase of $1 per day over the above rate. In the central competitive bituminous field the wage rate for team drivers, frequently used as a basic wage typical of average day labor, was $7.50 for a day of eight hours just prior to the strike.

"The operators contend that wages should be reduced in the coal industry in keeping with reduction in other industries. The miners contend that wages have not been raised in the coal industry above a proper wage, and also take issue with the argument that there should be uniform 'deflation' of wages. The miners further contend that their rate of daily wage is no measure of annual earnings, as their occupation is intermittent and irregular."

Gas Company Cooking Demonstration Scores for Local Churches

The Trinidad (Col.) Electric Transmission, Railway & Gas Company held a cooking demonstration in its main office July 18 to 21, inclusive.

The officials of the power company feel very much elated over the interest that was shown by the churches during this demonstration. There was a total attendance at the demonstration of 599 church members. The percentage of attendance by the different churches taken from the church register of each church is as follows:

Christian church, 288 per cent covering the four days.

Lutheran church, 272 per cent covering the four days.

Hebrew ladies, 45 per cent covering the four days.

Methodist Episcopal church south, 22 per cent covering the four days.

First Methodist Episcopal Church, 2 per cent covering the four days.

Episcopal church, 40 per cent covering the four days.

Presbyterian church, 10 per cent covering the four days.

After the demonstration, Mr. Creek, purchasing agent of the power company, expressed the appreciation of the management in reference to the interest shown by the different churches and assured all present that the gas company was now in a position to give service on gas in the future and that it would invite suggestions at all times that would benefit the service to the public at large. He stated that it was the company's policy to adjust all complaints cheerfully and that the company is putting forth every effort in its power to create a better feeling between the gas company and the gas consumer.

In view of this fact, and on account of the interest displayed between the two leading contestants in this demonstration—namely, the Christian church and the Lutheran church—having such a large attendance, their percentage being so close, the gas company gave each of these churches a No. 316 Lorain gas range to be installed in the respective churches, which met with the hearty approval of all present.

Pacific Coast Gas Association Holds Third "Get-Together" Dinner

The third "Get-Together" dinner-meeting of the Pacific Coast Gas Association, representing all of the gas-distributing utilities in California, Oregon and Washington, was held in Los Angeles, Cal., on the night of Saturday, Aug. 5. The gathering, which representatives from the three Western States attended, was held in the beautiful dining-room of the Los Angeles Athletic Club.

Frank S. Wade

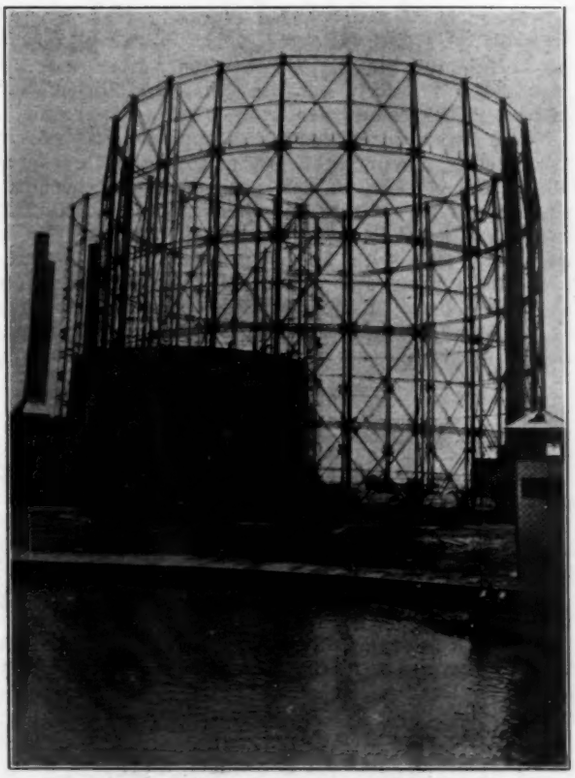
Frank S. Wade, superintendent of operation for the Southern Counties Gas Company of California, vice-president of the Pacific Coast Gas Association and one of the best known members of the Western gas fraternity, was chairman of the meeting. Superintendent Wade prepared a program replete with interesting addresses, merriment and music.

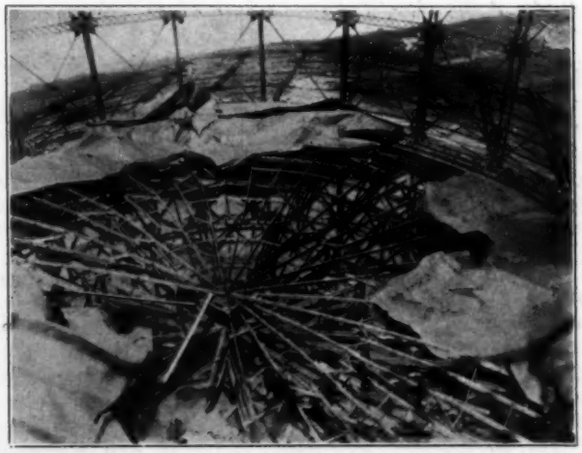
Lester S. Ready, assistant engineer for the California Railroad Commission, well known in the public utility circles of California and the Far West, was one of the chief speakers of the evening. Mr. Ready, who has taken an active part in the studies, deliberations and decisions of the commission for the past two years, talked on the subject "Public Utility Regulation."

H. L. Carnahan, formerly commissioner of corporations in California, prominent figure in the corporate circle of the State, addressed the gasmen on the subject "Financing a Public Utility."

Luther Brown, leading attorney and a representative of the Taxpayers' Economy League, spoke on "The Water and Power Act."

Representatives from most of the gas companies in the State and several from Oregon and Washington attended. A program for the afternoon of Aug. 5 was arranged by Frank Wade's committee. Automobiles furnished by the Southern Counties Gas Company took the men about the city.





Views of the holder of the Peoples Gas Light & Coke Company, Chicago, where a mysterious fire followed a leak. These pictures offer an excellent opportunity for engineers to make a study of the result of the accident.

Even a Crackerjack Window Needs Help

By Robert S. Merrill

The handsome kitchen in the gas company's window was all the better for not having a live woman in it. Her movements would have diverted the women who stopped to look; instead they were studying the equipment displayed. Also, they were absorbing clever suggestions as to fascinating occupations in the kitchen. And, of course, these occupations called for the use of gas.

This window—the most prominent one of the Peoples Gas Light & Coke Company of Chicago—was the work of an artist. It halted the passers-by on busy Michigan Boulevard and Adams Street. Yet it can be done as effectively by the gas company in the smallest city.

Suggestion was the keynote of the scene. A woman's apron folded across the back of a chair gave you the idea that the mistress had just stepped out of the kitchen. And if the mistress was absent, what woman could resist the temptation to peer into every corner of her kitchen? Women aplenty stopped. What those who were walking by themselves thought is a mystery; advertising men who make inquiries on Michigan Boulevard of solitary women are likely to be hauled off to jail as mashers. But the groups of women who stopped on a busy week day were interesting.

For one thing, the remarks showed that there are a lot of things that women have yet to learn about kitchen equipment. The fact that they are interested may point out some channels of informing them to gas companies. Do they know when the thing they see is the very thing they want?

One woman, from her gossip with the others, was apparently going to buy a range soon. She evidently had in mind one that somebody had told her about, for she mentioned a strong feature of its construction by its trade name. When asked what that meant, she tried to tell the others vaguely about it. She gave the range in the window a careless glance and added:

"When I get one, I'm going to have one with one of those thermostats on it so you can fix it and go away and leave it."

"Why, there's one now sitting on that kitchen cabinet," spoke up another woman, "and they're only two dollars. You can put them on any stove. See! There's one in the oven!"

It was a thermometer!

Yet the range exhibited was equipped with a regulator. More than that, it was the range which the woman had said she was going to buy!

Another group of women debated the construction of a kitchen cabinet: was it metal or wood? They seemed to arrive at no conclusion.

Now this is not a criticism of this particular window or any other display window nor even window-display methods. This window was a top-notcher. It compelled attention. It had what the artists call "composition." It hung together. It drove home one central idea by showing food and equipment to suggest the delights of a well-furnished kitchen. Everything down to a pan of apples and a paring knife on the sink board hinted at action. Only the actors themselves were missing.

Then what did the advertising man learn by a brief

study of the effects of this window upon the women who saw it?

First, that a display that suggests cooking and baking activities in a kitchen can be made without having a human being in it. That such a window is a magnet to women. That it concentrates attention upon the equipment and uses of the equipmet. That prominent features of equipment are discussed by the women but that they do not recognize these features when they see them.

Where does that get you? gasmen want to know.

Nowhere—but it is further proof that no one method is going to merchandise gas fixtures. Women are going to buy certain types of equipment when that type is so firmly fixed in their minds that they cannot ke switched from it unless greater merit is shown. It brings up again the conviction that a constant campaign of education is necessary. Newspaper advertising, literature, salesfolk and window display all are necessary.

Even then eternal vigilance is demanded. You could hardly say that the Chicago company lets any grass grow under its feet; it is a great merchandising concern. Yet if its thoroughness does not bring 100 expect when it relies upon spasmodic and half-per cent of results what can the smaller gas company hearted efforts to move appliances?

Let Newspaper Men Write the Ads

By Calvin Lindley

"Man is a selfish animal."

Picture him cherishing the typewriters, adding machines and other labor-saving devices in his office, while his wife confronts him with the old-fashioned iron and other wearisome devices.

Ideas like this could be used effectively by gas companies. This one was brought out most impressively when an editorial writer for one of the Chicago daily newspapers wrote an article advertisement for the Commonwealth Edison Company.

Incidentally gas companies might try that plan of having newspaper men write "a series of articles evidencing their interest in domestic thrift and independence," and run them in advertisement form.

Some extracts from one of the articles used in Chicago show the possibilities of making the husband think:

"Progress and efficiency, like charity, should begin at home, and usually don't. Man is a selfish animal. In our day we have seen him surround himself with the creature comforts of all times before his wife had even heard of them. Man had electric light in his office while woman was still illuminating her home with oil lamps. He sat with his feet on whistling radiators for many years while she passed most of her time in a clammy basement seeking coal to appease the appetite of a base burner. Reforms in lighting, ventilating, furnishing, financing and accounting all came to the office before they were thought necessary for the home."

"This is an age of machinery, but home economics seem to have lingered a long time in another age."

"Kitchen equipment until the past few years had been precisely the same as it was a century ago. Women cooked and baked and washed and ironed as their great grandmothers cooked and washed and ironed."

"There is no thrift in an economy that shortens lives and lengthens doctor bills. There should be no sentimental attachment between a housewife and a washboard merely because her grandmother wore out her knuckles and her youth bending over one."

"One may read an augury of hope for this generation in the growing tendency of the modern woman, who has lost none of her comeliness, her sprightly carriage or her neatness of appearance, to boast that she does her own housework—by machine, to be sure, but still with her own hands. The servant problem is going and with it all the petty vexations that were born of the thriftless, inefficient kitchen. It would seem that the dear old doddering human race is at last getting around to first principles."

Public Utilities Asked to Conserve Coal

Curtailment of coal in New York City to protect the public has been urged.

The reduction of public utilities service, if it can be done without injury, is one of the plans under consideration.

This was announced by the committee appointed by Chairman William A. Prendergast of the Public Service Commission to represent the gas, power, heat, light and traction interests of the State, which held its first meeting in the headquarters of the Public Service Commission recently.

Chief Engineer C. R. Vanneman of the Public Service Commission, an ex-officio member, said:

"The purpose of this committee is to work with the Governor's fuel committee, its particular function being to safeguard public interest by maintaining gas, electric and transportation service at the highest possible efficiency. The situation in respect to some companies in this State is critical.

"The committee expects to be able, by its action now, to avoid the heatless days and lightless nights that this State had to endure during the war. Fuel must be conserved. Power companies must pool their power resources and carry over those companies now unable to obtain coal.

"The executive committee, after a thorough canvass of the situation, will be prepared shortly to recommend a plan of action to E. H. Outerbridge, chairman of the Governor's fuel committee; Chairman William A. Prendergast of the Public Service Commission, and Chairman George McAneny of the Transit Commission."

Cuts Bond Issue

Trenton, N. J.—The State Public Utility Commission has approved the application of the Peoples Gas Company, operating in Millville and several other south Jersey municipalities, for the issuance of 7 per cent series A mortgage bonds amounting to $150,000. The company sought approval of a $250,000 issue, but the commission cut the amount.

The issue is to be used for organization expenses in connection with the merger of the Peoples Gas Company of New Jersey into the Peoples Gas Company, which merger was also sanctioned by the utility board. Part of the money raised by the issue will be used in improving the company's plant.

Public Utilities Securities Market Report

Prices of Representative Gas Bonds

(Quotations furnished by The National City Company)

Company	Issue	Maturity	Aug. 10, 1922 Bid	Asked
American Lt. & Trac. Co.	Five Year 6s	May 1, 1925	106½	107½
Brooklyn Union Gas Co.	First Consol. 5s	May 1, 1945	97	99
Columbia Gas & Elec. Co.	First 5s	May 1, 1927	95½	96½
Consol. Gas, Elec. Lt. & Pr. Co. of Baltimore	First Ref. 7½s	Dec. 1, 1945	109	110
Consol. Gas, Elec. Lt. & Pr. Co.	General 4½s	Feb. 14, 1935	88½	90
Consol. Gas Co. of New York	Sec. Conv. 7s	Feb. 1, 1925	102	—
New Amsterdam Gas Co.	First Consol. 5s	Jan. 1, 1948	82	84
Denver Gas & Elec. Co.	Gen. (now 1st) 5s	May 1, 1949	92½	93½
Detroit City Gas Co.	Gold 5s	Jan. 1, 1923	100	—
Equitable Illum. Gas Lt. Co. of Philadelphia	First 5s	Jan. 1, 1928	100½	102
Hudson County Gas Co.	First 5s	Nov. 1, 1949	89	90
Laclede Gas Light Co.	Ref. & Ext. 5s	Apr. 1, 1934	91¼	93
Louisville Gas & Elec. Co.	First & Ref. 7s	June 1, 1923	100	101
Michigan Light Co.	First & Ref. 5s	Mar. 1, 1946	88	89½
Milwaukee Gas Light Co.	First 4s	May 1, 1927	92½	93
Pacific Gas & Elec. Co.	Gen. & Ref. 5s	Jan. 1, 1942	91	91½
Pacific Gas & Elec. Co.	First & Ref. 7s	Dec. 1, 1940	105½	107
Cal. Gas & Elec. Corp.	Unif. & Ref. 5s	Nov. 1, 1937	96½	97
Peoples' Gas Lt. & Coke Co.	Refunding 5s	Sept. 1, 1947	91	94
Chicago Gas Lt. & Coke Co.	First 5s	July 1, 1937	95	97
Portland Gas & Coke Co.	First & Ref. 5s	Jan. 1, 1940	89	90
Seattle Lighting Co.	Refunding 5s	Oct. 1, 1949	82	83½
Southern California Gas Co.	First 6s	Nov. 1, 1950	96	98
Utica Gas & Electric Co.	Ref. & Ext. 5s	July 1, 1957	90⅜	—
Washington Gas Light Co.	General 5s	Nov. 1, 1960	94⅜	95
Western States Gas & Elec. Co. of California	First & Ref. 5s	June 1, 1941	89	92

Amend Order in Knoxville Gas Case

Nashville, Tenn.—In an order issued by the Tennessee Railroad and Public Utilities Commission in the Knoxville gas rate case on June 13, 1922, it was set out that the minimum bill for domestic consumers of gas in Knoxville should be $1.50 per month, for which minimum the customer would be entitled to the use of 400 cu. ft. of gas, and further that the domestic rate for gas and in excess of the minimum allowance should be $1.25 per thousand cubic feet.

The commission amended its order as follows:

"That the minimum bill for domestic consumers of gas in Knoxville, Tenn., shall be $1.50 per month, for which minimum the customer shall be entitled to the use of 200 ft. of gas."

The order was approved and signed by J. W. Campbell, chairman, and W. N. Beasley, and submitted by mail to General Harvey H. Hannah, the Democratic member of the commission. General Hannah declined to sign the order for the reasons set out in the following dissenting opinion:

"I respectively dissent from opinion and order of the majority, dated July 25, 1922, in the Knoxville Gas Company case for the reason:

"1. This order increases the gas rate on ex-parte showing.

"2. Order of this commission dated June 13 reducing the gas rates in Knoxville to $1.50 minimum charge, entitling the customer to 400 cu. ft. of gas and all over that amount to be charged at rate of $1.25 per thousand cubic feet was entered after full and complete hearing.

"3. The rates established June 13 were estimated to net the company a reasonable rate of return on the valuation previously established by this commission after appraisal of property by experts.

"4. Neither the company nor the commission is in a position at this time to say that the rates in order of commission of June 13 are inadequate, because they have not been tried out.

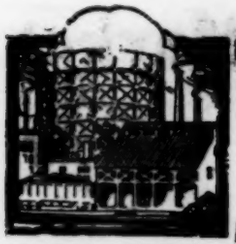
"5. The order of the majority dated July 28 allows an increase of approximately 10 cents per thousand cubic feet over the rates established in order of June 13, by reducing the amount of gas under the minimum from 400 to 200 cu. ft.

"6. The present conditions and decline in prices of labor and materials does not justify any increase in rates should be made without a full hearing of the facts."

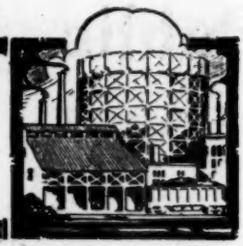
In giving out the dissenting opinion of General Hannah, Chairman Julian Campbell of the Utilities Commission gave out the following:

"General Hannah's dissenting opinion in the Knoxville gas case has just been filed, and I am sorry he is not here so that I can refresh his memory that a hearing was had on May 1 and 2, 1922, and that he was present.

"Since then the commission's engineers have made a thorough investigation of the Knoxville Gas Company and the rates now in effect are lower than the consumers of the Knoxville Gas Company have paid since Dec. 7, 1920, as the order of June 13, 1922, was corrected before accounts were rendered thereunder."



NEWS OF THE GAS INDUSTRY



To Investigate Gas Industry

The New York *American* in its issue of Thursday, Aug. 10, published the following dispatch. It is reprinted here for the information of the gas industry:

(*By International News Service.*)

WASHINGTON, Aug. 9.—The price of illuminating gas as used in hundreds of thousands of American homes will be subjected to a Senatorial inquiry as part of the La Follette oil probe.

The petroleum investigation now in full swing before the Senate manufactures committee, to determine the relationship between gas and oil companies as affecting the price of illuminating gas in hundreds of American cities.

This phase of the probe, it was stated, will be pressed in an effort to learn whether combinations were effected to maintain high gas prices.

Directed at Standard Oil

The first step was taken to-day when Senator McNary, Republican, of Oregon, invited former Attorney-General William S. Jackson, of New York, to participate in the questioning of witnesses. Jackson was sent to the hearings by Mayor John F. Hylan of New York City to safeguard the interests of New York's greatest lighting and heating facilities.

While the Senate probe was directed principally at the alleged price manipulations of the Standard Oil Company and its subsidiary concerns, the committee holds authority to extend its investigation to an unlimited degree. Senator McNary, who is conducting the hearings in the absence of Senator La Follette, Republican, of Wisconsin, announced today there would be no limit imposed on the inquiry.

Better Conditions in New York

Jackson, who participated in today's session of the committee, announced he would give the committee every assistance in probing Standard Oil operations, and added:

"Mayor Hylan of New York hopes the Senate inquiry will help to better conditions in New York City and throughout the country in regard to the supply and prices of gas oil used extensively in making gas for heating and lighting purposes.

"In the recent series of suits brought in the Federal courts of New York by gas companies of New York City to have the 'eighty-cent gas law' declared unconstitutional as confiscatory, the main reason advanced by gas companies upon which the courts enjoined enforcement of the rates was the increased price of gas oil. The result, of course, has been an increased toll of millions taken by Standard Oil interests out of the citizens of New York City alone."

Pacific Gas & Electric Earns 5.2 Per Cent in Six Months

Pacific Gas & Electric Company earned 5.2 per cent on its $34,619,000 common stock during the six months ended June 30, 1922, business establishing a new record which was cumulative throughout, with June the heaviest month in the company's history. Comparative income account for the first half year follows:

	1922	1921	Changes
Gross	$19,490,813	$18,967,196 Inc.	$523,627
Net after taxes	7,590,666	6,750,774 Inc.	849,892
Interest and amortizat'n disc.	2,740,071	2,236,671 Inc.	103,400
Balance after int. and amort.	4,850,595	4,104,003 Inc.	746,492
Depreciation	1,790,921	1,534,539 Inc.	256,382
Balance after charges	3,059,674	2,569,564 Inc.	490,110
Preferred dividends accrued.	1,259,455	1,061,222 Inc.	198,233
Balance for common	1,800,219	1,508,342 Inc.	291,877

Sales of electrical energy during June increased 8,295,094 kw. over June, 1921, or by 8.64 per cent. Among the more conspicuous increases in distribution were 12,92 per cent for commercial and residential lighting, 13.36 per cent for agricultural power and 17.97 per cent for manufacturing industries. Net gain for the six months in number of customers served was 14,062, while the total gain for the past twelve months was 30,066.

Effective July 15, the price of oil residuum used by the company in gas making was reduced 25 cents a barrel, followed by a similar reduction July 25. Under the policy adopted by the State Railroad Commission adjustments in gas rates corresponding to changes in oil prices are made effective within thirty days.

This means that beginning Aug. 25 the company will be obliged to reduce its gas rates from 5 to 14 cents a thousand cubic feet. This, however, is not expected to entail any loss in net revenues, while the lower rates should stimulate consumption.

Dividend Is Resumed by Gas Company

In addition to announcing a resumption of dividends at the 7 per cent rate, the Laclede Gas Company, of St. Louis, showed gross earnings for the six months ended June 30 of $4,000,295.

After deduction of $2,618,801 operating expenses and $919,144 for interest and preferred dividends, surplus was $462,350, equivalent to $4.32 a share earned on the 107,000 shares of common stock.

New High for Laclede

The recent increase in the Consolidated Gas dividend rate has acted bullishly upon Laclede Gas Light stock sentiment, and this issue established a new high for the year above 89.

Gas Company Has Large Coal Supply

Hamilton, Ohio.—In an interview with W. W. O'Brien, manager of the Decatur branch of the Northern Indiana Gas & Electric Company, it was stated that residents of this city need not fear a shortage of gas on account of the coal shortage due to the prolonged strike of miners. The company has a supply of coal at the plant in Fort Wayne sufficient to last for ninety days or more.

Mr. O'Brien stated in the interview:

"Prior to April 1 the company, in anticipation of possible interruption of delivery of gas-making materials purchased and stored at the works approximately ninety days' supply of gas coal, steam coal and coke, and from time to time since April 1 has purchased additional coal and coke as a further protection of the continued manufacture of gas furnished to the citizens of Fort Wayne, Decatur and Bluffton. Much of this coal has been bought at prices that under normal conditions would be considered very high, but it was felt that every possible precaution should be taken to prevent the failure of the gas supply. Much of this material had to be hauled and stored and again rehauled to the boilers and gas-making machines, with the result that the cost of gas to the company has materially increased by reason of these unusual conditions."

Mr. O'Brien further stated that the company had a little better than a two months' supply of coal and coke on hand at the present time, therefore there need be no immediate fear on the part of the citizens of Decatur in regard to continued manufacture of gas, while, as before stated, the extraordinary expense the company has been put to in the matter of securing and handling this surplus stock of gas-making materials has been quite heavy, but it is a source of much satisfaction to the company to feel that every reasonable precaution has been taken in the interest of its customers.

Seek Increase in Gas Rates

Harrisburg, Pa.—A petition for an increase in gas rates at Jamestown has been filed with the Public Service Commission of New York State by the Pennsylvania Gas Company, furnishing gas to local consumers. Under a tariff which became effective July 1 a year ago, the rates were fixed at 40 per cent per thousand for the first 10,000 cu. ft. per month, 50 cents for the next 5,000 and 55 cents for all over 15,000 cu. ft.

The present rate became effective on July 1 a year ago, the commission in that decision allowing the company alleges that it has received sale of gas in New York State. The company alleges that it has received only $563,137. It also claims that the allowance made for expenses and taxes was insufficient, alleging that the total deficit in revenue amounts to $164,055.20, which the company asks to be included in the rate for the coming year. The rate which the company proposes to ask the commission to establish is not specified in the petition.

Additional Gas Equipment at Shenandoah, Iowa

Order has recently been placed for additional equipment to be used in connection with the water gas plant at Shenandoah. This is required in connection with the four foot six inch water gas set which is now being built for this city by the Western Gas Construction Company, who also secured the order for the additional work.

Cheaper Gas at Sioux City

Sioux City, Iowa.—Gas and electric rates will be reduced in Sioux City Sept. 1, providing the voters on Aug. 28 authorize the city council to grant the Sioux City Gas & Electric Company two new franchises each to run twenty-five years, one relating to gas and the other to electric service. Ordinances relating to each service were placed on their first and second readings at the council meeting this morning. They call for a gas reduction of 10 cents for each thousand cubic feet. The present net rate is $1.35 for each thousand cubic feet. Electricity is to be reduced from 11 cents to 9 cents per kilowatt hour.

Tar Extractor for Winona

Contract has recently been placed by the Wisconsin-Minnesota Light & Power Company covering a new tar extractor with a special by-pass designed to properly accommodate the existing apparatus at their plant at Winona, Minn. The new equipment is being fabricated for them by the Western Gas Construction Company.

Charlottesville Operations for June

Charlottesville, Va. — Operation of the gas plant during June was very satisfactory, says City Manager Washabaugh, in his monthly report, although the coal reserve has been cut down to practically a minimum.

Twenty new services were installed during the month.

On hand July 1: 111 tons of coal, 10,935 gal. gas oil, 1,200 bushels coke. This coke is not for sale, as we are holding it in reserve in case of coal shortage.

The storage tank and still for distilling creosote and light oils will be erected during the coming month.

New Gas Equipment for Washington, N. C.

Contract has recently been placed covering a four foot water gas set complete with steam operated coke hoist, also two duplex design steel purifier boxes with connections for same. This apparatus will all be furnished and erected complete in the plant of the Washington Gas Company by the Western Gas Construction Company.

One Result of the Strike

The Colorado Fuel & Iron Company in early August shut down part of their plants, laying off about 1,500 men. It is said that there will be a saving of some 2,000 tons of coal a day and that such saving is necessary to meet the demands of other concerns.

Allison Joins Hoffman

C. B. Allison, formerly connected with the Ruud Manufacturing Company, at Louisville, Ky., for the past eighteen years, has severed his connection with the Ruud Company and has joined the Hoffman Heater sales staff.

Coal from Abroad

Hartford, Conn.—The Hartford Gas Company has imported 6,000 tons of Welsh coal, due to the shortage in domestic short coal.

Natural Gas

Natural gas was first mentioned by Thomas Shirley in a communication to the Royal Society of England in 1667.

Has Narrow Escape from Death

Long Beach, Cal.—Henry Werner, an employee of the Southern Counties Gas Company in this city, had a narrow escape from death here recently when he was blown five feet into the air when a plug in a gas main at Brayton Avenue and Burnett Street blew out.

Werner, together with a number of other employees of the company, was working on the gas main, which supplies natural gas to the oil wells on Signal Hill, California's newest oil and gas field, when the heavy pressure forced the plug out and lifted Werner out of the ditch and into the air.

With the exception of a few bruises and being slightly stunned by the blast, Werner was uninjured.

Can Issue Preferred Stock

San Francisco, Cal.—The Southern California Edison Company, one of the largest hydro-electric power distributing utilities in the United States, has been granted permission by the State Railroad Commission in a decision announced recently to reclassify its stock and to issue and sell $9,500,000 of 7 per cent cumulative non-participating preferred stock to retire outstanding second preferred stock and for development work.

According to plans of the company outstanding first preferred stock amounting to $4,000,000 will be designated as original preferred. Second preferred amounting to $12,000,000 is to be retired and the common stock is to be reduced from $83,500,000 to $60,000,000 and a meeting of the stockholders called for Aug. 1 is expected to ratify these changes.

The company's authorized capitalization of $100,000,000 will then consist of $4,000,000 of original preferred, $36,000,000 of 7 per cent cumulating non-participating preferred and $60,000,000 of common stock.

Gas Rate Reduced

San Francisco, Cal.—A second reduction within a month was ordered July 21 by the Railroad Commission in the gas rates applying to Lodi, San Joaquin County, the present cut being 8 cents per thousand cubic feet, effective on meter readings on Aug. 15. In the latter part of June the Lodi rate was reduced 18 cents a thousand cubic feet. Lodi is served by the Sacramento Gas Company.

The company was also directed to make a straight reduction of 10 cents a thousand cubic feet for gas consumed in the city of Sacramento.

Bond Issue Authorized

San Francisco, Cal.—Declining interest rates are reflected in a modified order recently issued by the Railroad Commission permitting the San Diego Consolidated Gas & Electric Company to issue in place of $1,500,000 6 per cent bonds a like amount of 5 per cent bonds. The minimum selling price of the 5 per cent issue was fixed at 82 per cent of face and accrued interest. The company had asked to sell the bonds at not less than 80.

News from the Oil and Gas Fields

Extensive drilling is promised in the San Juan oil field in Utah, the directions being east as well as south.

Weowna Oil & Refining Company, of Winnett, Mont., has declared an initial dividend of 5 per cent, amounting to 50 cents a share, payable Aug. 1 to stockholders of July 25.

The Arrow Oil & Refining Company has declared its semi-annual dividend of 6 per cent and elected the following officers: H. A. Hover, president; H. H. Schwartz, Jr., vice-president; Eugene DeMers, secretary; E. S. Allen, treasurer.

The gasoline State tax must not tax gasoline sold for farm use, and stationary engines, therefore James Duce, Colorado oil inspector, has asked the auditing board for funds to refund something like $11,000.

Six new wells in the Salt Creek field have lately come in, adding 2,485 bbl. to the old reliable's output.

Indiana General Service Co.

Boston, Mass.—Dillon, Read & Co. are offering $3,322,000 Indiana General Service Company first mortgage 5 per cent gold bonds due Jan. 1, 1948. The bonds are secured by direct first mortgage lien on a substantial part of the company's property and on the rest of the property are subject only to two closed underlying divisional liens, of which $1,000,500 is held by the public and $1,003,500 is pledged under this mortgage. The properties covered by the mortgage lien are valued by the company's engineers as of May 31, 1922, at $7,428,000. The American Gas & Electric Company owns the entire common stock of the Indiana General Service Company and is closely identified with General Electric interests. The bonds are being offered at 90 and accrued interest, to yield 5.75 per cent.

Locate Plant in Birmingham

Birmingham, Ala.—The Air Reduction Sales Company has purchased three and a half acres of ground here and will immediately build a plant for the manufacture of gases and equipment for the oxyacetylene welding and cutting industry. A total of $250,000 is to be invested in the plant.

Buildings to be erected at once are a gas house, carbide storage, generating house, empty can storage and office. Construction of a modern acetylene plant will also commence at once. The products of the company which are marketed under the trade names "Airco" and "Airco-Davis-Bournonville" include oxygen, acetylene, nitrogen, argon and other atmospheric gas products.

Water-Gas Set for York, Neb.

The new gas-making equipment recently contracted for by the Nebraska Gas & Electric Company (formerly the Public Service Company of York, Neb.) includes a four foot six inch water gas set with steam operated coke hoist, coke bucket and other apparatus. The contract for this work was placed through the Continental Gas & Electric Corporation, of Omaha, with the Western Gas Construction Company.

Shortage of Coal Causes Cut in Hours' Gas Service

Marquette, Mich.—Shortage of coal here has forced the Marquette Gas Company to cut its service to three hours a day and, beginning July 29, it has announced, gas will be furnished during meal hours only. The company officials are trying to borrow coal from other cities, as the supply of the coal dealers here is down to rock bottom and no coal is being shipped up the lakes.